



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

B 1,034,461

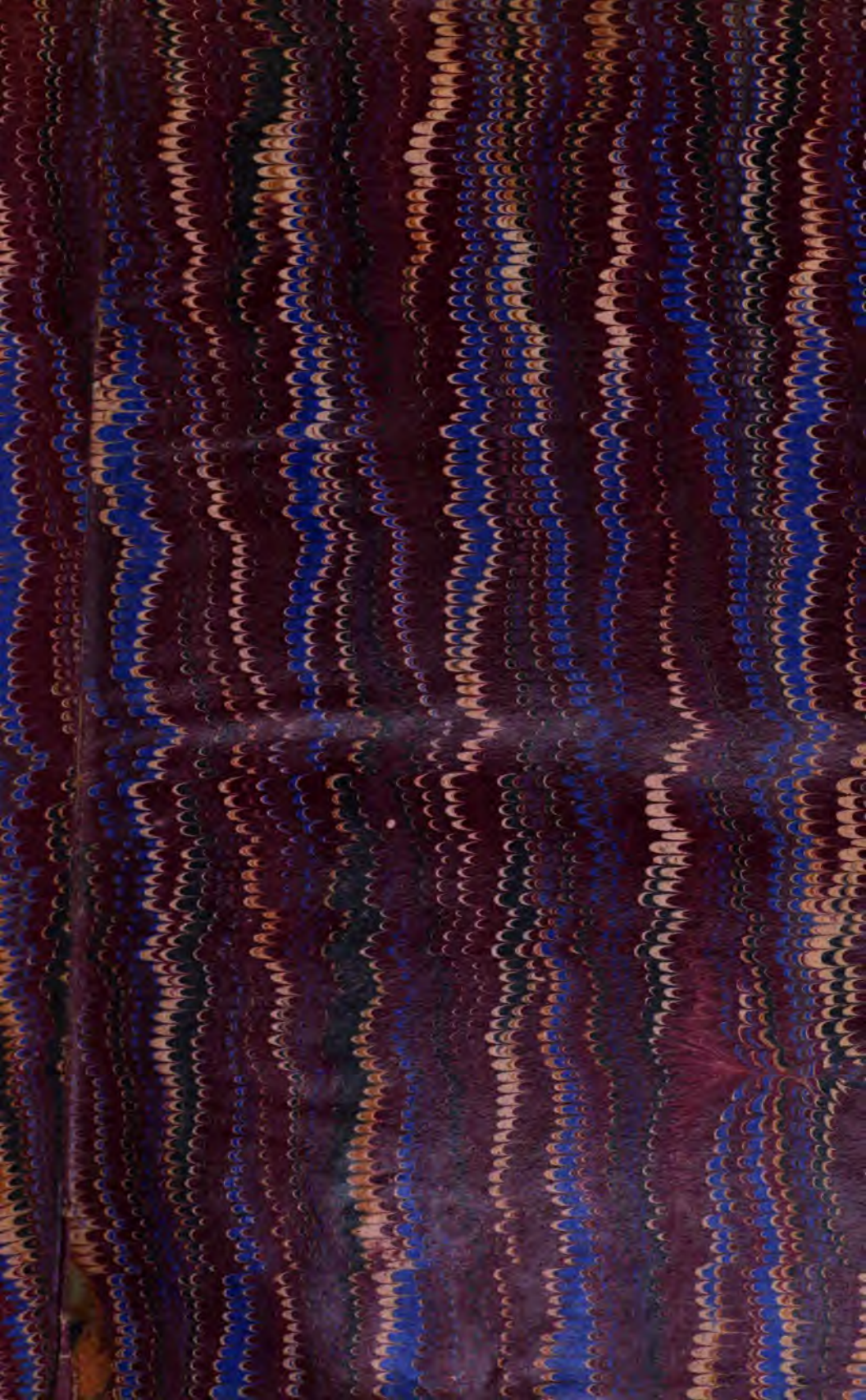


GENERAL LIBRARY of the
UNIVERSITY OF MICHIGAN

PRESENTED BY

War Dept.

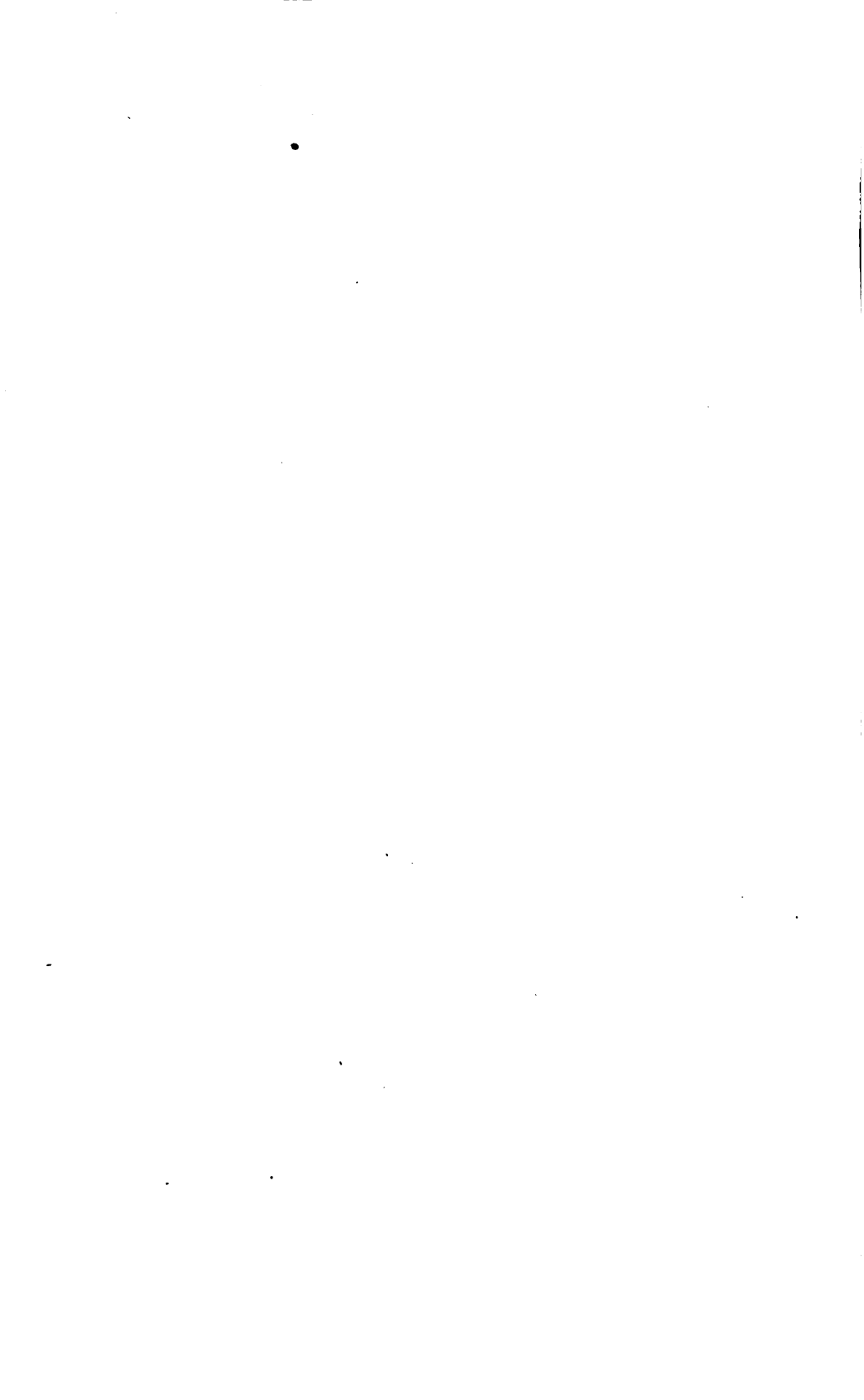
2/4/05

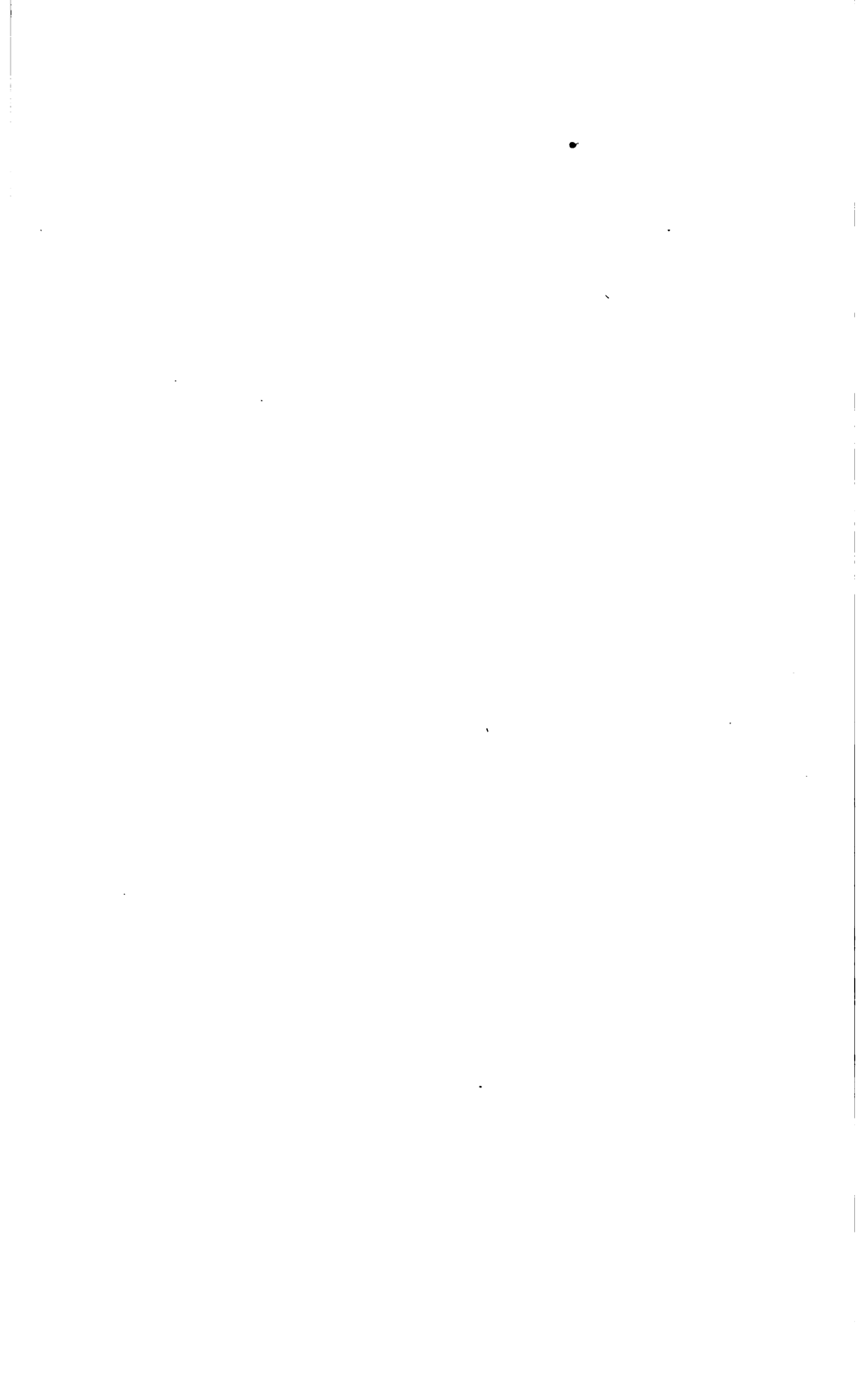




UA
24
A15







ANNUAL REPORTS

OF THE

WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1903.

VOLUME IX.

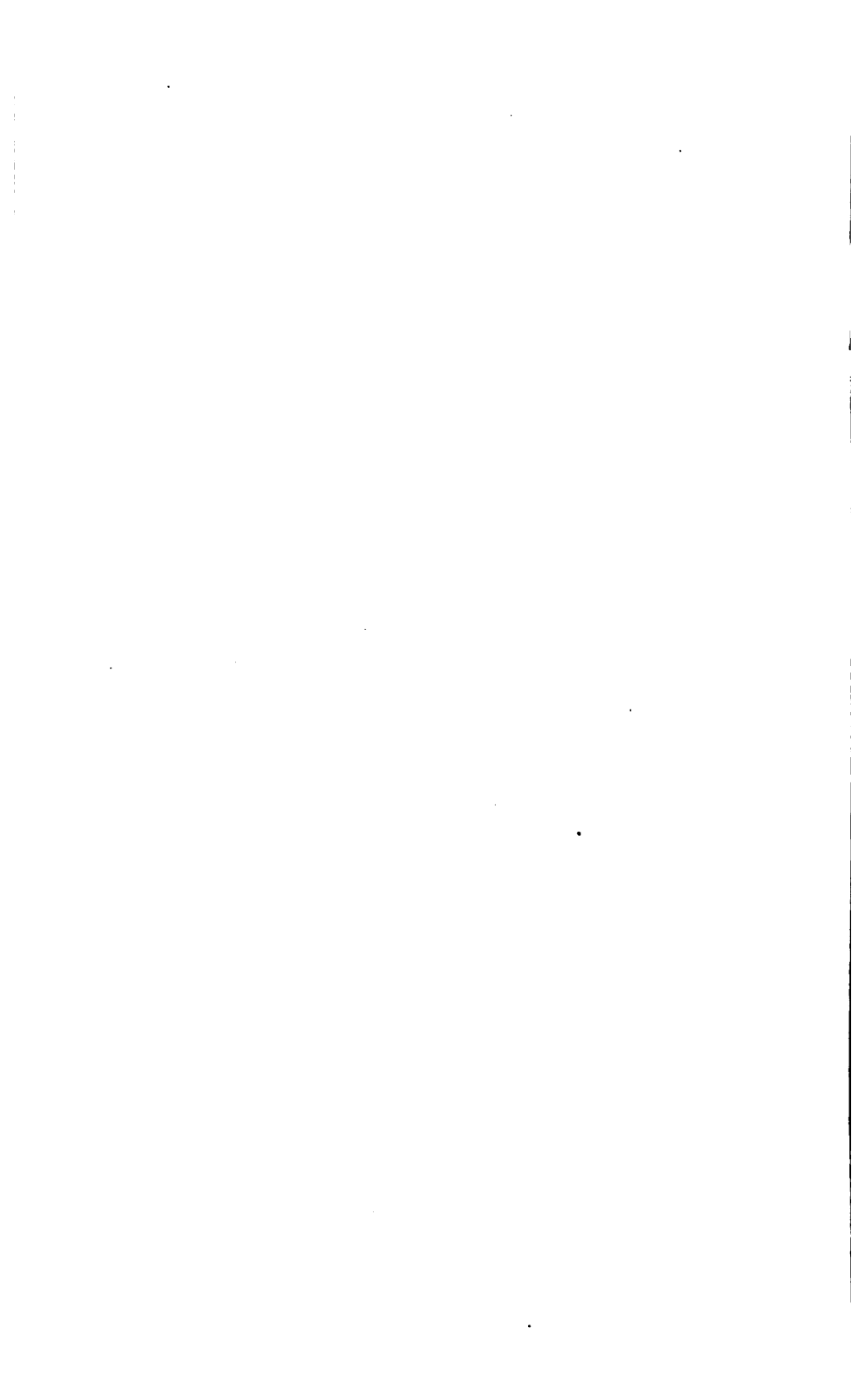
REPORT OF THE CHIEF OF ENGINEERS.

PART 1.

WASHINGTON:

GOVERNMENT PRINTING OFFICE.

1903.



ARRANGEMENT OF THE ANNUAL REPORTS OF THE WAR DEPARTMENT FOR THE YEAR ENDED JUNE 30, 1903.

Volume I.—Secretary of War:

- Chief of Staff.
- Adjutant-General.
- Inspector-General.
- Judge-Advocate-General.

Volume II.—Armament, Transportation and Supply:

- Quartermaster-General.
- Commissary-General.
- Surgeon-General.
- Paymaster-General.
- Chief of Engineers, Military Affairs.
- Chief of Ordnance.
- Chief Signal Officer.
- Chief of Artillery.
- Board of Ordnance and Fortification.

Volume III.—Department and Division Commanders:

- Department of California.
- Department of the Colorado.
- Department of the Columbia.
- Department of Dakota.
- Department of the East.
- Department of the Lakes.
- Department of the Missouri.
- Department of Texas.
- Division of the Philippines—
 - 1. Department of Luzon.
 - 2. Department of the Visayas.
 - 3. Department of Mindanao.

Volume IV.—Military Schools and Colleges; Record and Pension Office;

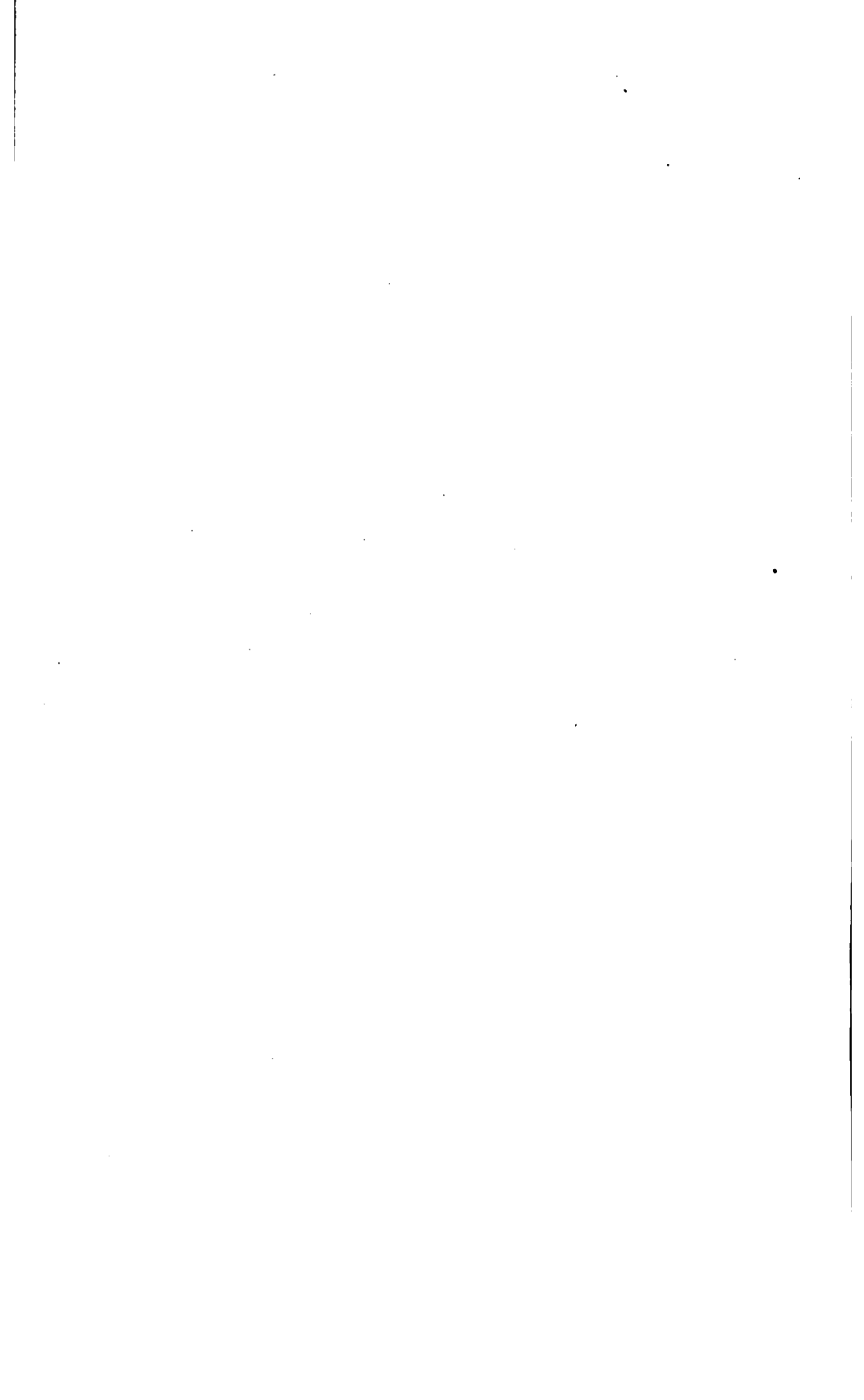
Military Parks, and Soldiers' Homes:

- Military Academy—
 - 1. Board of Visitors.
 - 2. Superintendent.
- Army War College.
- General Service and Staff College.
- School of Application for Cavalry and Field Artillery.
- Artillery School.
- School of Submarine Defense.
- Chief of Record and Pension Office.
- Commissioners of National Military Parks—
 - 1. Chickamauga and Chattanooga.
 - 2. Gettysburg.
 - 3. Shiloh.
 - 4. Vicksburg.
- Soldiers' Home, District of Columbia—
 - 1. Board of Commissioners.
 - 2. Inspection of.

Inspection of National Home for Disabled Volunteer Soldiers.

Volumes V-VIII.—Reports of the Philippine Commission, the Chief of Bureau of Insular Affairs, and Acts of the Philippine Commission.

Volumes IX-XIII.—Chief of Engineers, River and Harbor Improvements.



ANNUAL REPORT
OF THE
CHIEF OF ENGINEERS,
UNITED STATES ARMY.

1903.

ANNUAL REPORTS

OF THE

WAR DEPARTMENT

FOR THE

FISCAL YEAR ENDED JUNE 30, 1903.

VOLUME IX.

REPORT OF THE CHIEF OF ENGINEERS.

PART 1.

**WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1903.**



ANNUAL REPORT
OF THE
CHIEF OF ENGINEERS,
UNITED STATES ARMY.

1903.

REPORT

OF

THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, September 29, 1903.

SIR: I have the honor to present for your information the following report upon the duties and operations of the Engineer Department for the fiscal year ending June 30, 1903:

OFFICERS OF THE CORPS OF ENGINEERS.

The number of officers holding commissions in the Corps of Engineers, U. S. Army, at the end of the fiscal year was 153.

Since the last annual report the Corps of Engineers has lost 7 of its officers—Second Lieut. Francis F. Longley, who resigned September 2, 1902; Capt. Robert McGregor, who died December 23, 1902; Lieut. Col. Andrew N. Damrell, who was retired from active service on account of disability incident thereto, January 29, 1903, under the provisions of section 1251, Revised Statutes; Col. Samuel M. Mansfield, Col. Jared A. Smith, and Col. Peter C. Hains, who were appointed brigadier-generals, United States Army, February 20, April 13, and April 21, 1903, respectively; and First Lieut. Edmund M. Rhett, who resigned June 4, 1903.

There were added to the Corps of Engineers, by promotion of graduates of the Military Academy, 10 second lieutenants on June 22, 1903, to rank from June 11, 1903.

On the 30th of June, 1903, the officers were distributed as follows:

Commanding the Corps of Engineers and Engineer Department, Board of Ordnance and Fortification, and War College Board.....	1
Office of the Chief of Engineers, Provisional General Staff, and Light-House Board.....	1
Office of the Chief of Engineers.....	5
Division engineer and The Board of Engineers.....	1
Division engineer, river and harbor works, and light-house district.....	1
Division engineer, river and harbor works, The Board of Engineers, and Light-House Board.....	1
Division engineer, Mississippi River Commission, river and harbor works, and engineer officer, Department of the Lakes.....	1
Division engineer, California Débris Commission, and engineer officer, Department of California.....	1

Fortifications, river and harbor works, and light-house districts	6
Fortifications and river and harbor works	14
The Board of Engineers, river and harbor works, and International Congress ..	1
Washington Aqueduct	2
River and harbor works	15
The Board of Engineers and engineer officer, Department of the East	1
Division engineer, fortifications, river and harbor works, and California Débris Commission	1
River and harbor works and light-house districts	3
Fortifications and light-house district	1
Division engineer, Mississippi River Commission, fortifications, and river and harbor works	1
Division of the Philippines	20
Division engineer, fortifications, and river and harbor works	1
Light-House Establishment	2
En route from the Philippine Islands	9
Provisional General Staff	3
Public buildings and grounds, District of Columbia	1
Post of Fort Leavenworth, First Battalion of Engineers, and engineer officer, Department of the Missouri	1
With Isthmian Canal Commission	2
Survey of Northern and Northwestern lakes	1
Mississippi River Commission, river and harbor works, and light-house district ..	1
Engineer Commissioner, District of Columbia	1
Post of Washington Barracks, Engineer School of Application, and Third Battalion of Engineers	10
River and harbor works and Yellowstone National Park	1
Provisional General Staff and Department of the Columbia	1
United States Military Academy	6
Assistants to Engineer Commissioner, District of Columbia	2
Post of Fort Leavenworth, and First Battalion of Engineers	16
Fortifications, river and harbor works, and engineer officer, Department of Texas ..	1
Fortifications, river and harbor works, and Vicksburg National Military Park ..	1
Buildings for War College, Washington Barracks, and Government Printing Office	2
California Débris Commission	1
Mississippi River Commission	1
The Board of Engineers	1
Adjutant-General's Office, United States Army	1
Graduating leave of absence	10
Total	153

The duties devolving upon the Corps of Engineers have been increasing year by year and are now greater than ever before in its history. These duties now include the command of three battalions of troops; the construction of fortifications; superintending works of river and harbor improvements; the construction and repair of light-houses; the construction of public buildings; the water supply, the municipal engineering, care of public buildings and grounds, and a share in the city government of the capital of the United States; the improvement of the Yellowstone National Park; the survey of the Northern and Northwestern lakes; the mining and debris commission in the State of California, all or which involve the expenditure of many millions annually, and, in addition to various other duties, supervision of military engineering and reconnaissance work in the several military departments and instruction at the Military Academy and schools of application.

The act of February 2, 1901, increased the organization of the Corps of Engineers from 127 officers to 160 and the enlisted strength from one battalion to three battalions. The increase of officers was made up of 5

captains, 10 first lieutenants, and 18 second lieutenants. The extra battalions require the exclusive service of the following officers: Two majors, 8 captains, 12 first lieutenants, and 8 second lieutenants; the net effect of the increase was the loss of 7 officers from the grades which are most effective for duty other than with troops.

While the organization of the Corps of Engineers provides for 160 officers, law, orders, and regulations now provide for not less than 110 positions that must be filled by officers of the Corps of Engineers, independent of duties relating to construction of fortifications and works of river and harbor improvements. A further reduction in number of not less than 16 must be considered for officers sick, on leave, or undergoing instruction at schools of application. As a result there remain but 27 officers specially available for construction work in not less than 54 engineering districts throughout the country.

At the present time it is necessary to so combine works and districts as to throw upon many officers such a number and variety of duties as to make it difficult at times for them to devote to the separate districts and the various items of work the proper detailed consideration.

It is urgently recommended that the number of officers in the Corps of Engineers be increased from 160 to 185, which number, it will be noted from what precedes, is the very least that can properly provide for supervision of the work now assigned by law and regulations.

ENGINEER TROOPS.

The existing law fixing the organization of the Army provides for three battalions of engineers, each made up of four companies.

During the past fiscal year the stations and duties of these battalions and the names of the officers serving therewith were as follows:

FIRST BATTALION OF ENGINEERS.

(Fort Leavenworth, Kans.)

Maj. Smith S. Leach, commanding.

First Lieut. Harry Burgess, adjutant.

First. Lieut. Sherwood A. Cheney, quartermaster and commissary.

COMPANY A.

Capt. Thomas H. Rees.

First Lieut. Frederick W. Altstaetter, until August 3, 1902.

First Lieut. Horton W. Stickle.

Second Lieut. Nathaniel E. Bower.

Second Lieut. Laurence V. Frazier, from October 1, 1902.

COMPANY B.

Capt. George A. Zinn, until February 26, 1903.

Capt. Herbert A. Deakyne, since February 26, 1903.

First Lieut. Francis A. Pope.

Second Lieut. Wildurr Willing.

COMPANY C.

Capt. Clement A. F. Flagler.

First Lieut. George M. Hoffman.

Second Lieut. Robert R. Ralston, since October 1, 1902.

COMPANY D.

Capt. James B. Cavanaugh, until May 25, 1903.
Capt. Robert R. Raymond, since June 14, 1903.
First Lieut. Gilbert A. Youngberg.
Second Lieut. Clarence H. Knight.

During the year the battalion took part in the annual maneuvers at Fort Riley, Kans., where its work received special commendation from the commanding general, Department of the Missouri. It also took part in the ceremonies incident to the dedication of the Louisiana Purchase Exposition at St. Louis. Companies A, B, and C, with ponton-bridge equipage, took part in the rescue and relief of citizens imperiled by the floods on the Missouri River during the spring of 1903.

SECOND BATTALION OF ENGINEERS.

(Philippine Islands.)

Lieut. Col. Clinton B. Sears, commanding, until May 7, 1903.
First Lieut. James A. Woodruff, adjutant.
First Lieut. Edward M. Markham, quartermaster and commissary.
First Lieut. Edward M. Adams, quartermaster and commissary, Companies E and F, since May 28, 1903.

COMPANY E.

Capt. Henry Jervey, detached.
First Lieut. William Kelly, until September 17, 1902.
First Lieut. George B. Pillsbury.
First Lieut. Edward N. Johnston, until October 2, 1902.
First Lieut. George R. Spalding.

COMPANY F.

Capt. Robert McGregor, detached. (Died December 23, 1902.)
First Lieut. Lytle Brown, until September 17, 1902.
First Lieut. Earl I. Brown.
First Lieut. Curtis W. Otwell.
First Lieut. Elliott J. Dent.

COMPANY G.

Capt. Jay J. Morrow, until May 5, 1903.
First Lieut. Amos A. Fries.
First Lieut. Lewis H. Rand, since November 13, 1902.
First Lieut. John R. Slattery, until September 17, 1902.
First Lieut. Hubert L. Wigmore.
First Lieut. Ernest D. Peek.

COMPANY H.

Capt. William W. Harts.
First Lieut. Lewis H. Rand, until November 13, 1902.
First Lieut. Gustave R. Lukesh.
First Lieut. Clarence O. Sherrill.
Second Lieut. William G. Caples.
Second Lieut. Arthur Williams.
Second Lieut. William A. Mitchell, November 3, 1902, to June 2, 1903.
Second Lieut. Warren T. Hannum, November 3, 1902, to June 2, 1903.

During the year the battalion was engaged in road and bridge work, map making, reconnaissances, and other engineering work usually falling to engineer troops in the field. A detachment from Company G took part in the campaign against the Lake Lanao Moros. On June 14, 1903, Companies G and H sailed for the United States, having been relieved by Companies I and K of the Third Battalion of Engineers.

THIRD BATTALION OF ENGINEERS.

(Washington Barracks, D. C.)

Maj. William M. Black, commanding, until April 1, 1903.

Maj. Edward Burr, commanding, since April 1, 1903.

First Lieut. Frank C. Boggs, adjutant.

First Lieut. William D. Connor, quartermaster and commissary, until September 19, 1902.

First Lieut. Thomas H. Jackson, quartermaster and commissary, since September 20, 1902.

First Lieut. Edward M. Adams, quartermaster and commissary Companies I and K, since May 28, 1903.

COMPANY I.

Capt. Spencer Cosby, since April 2, 1903.

First Lieut. William J. Barden, September 1, 1902, to April 15, 1903.

First Lieut. Thomas H. Jackson, until September 19, 1902.

First Lieut. Edward M. Adams, January 23, 1903, to May 28, 1903.

First Lieut. John R. Slattey, January 7 to April 24, 1903.

First Lieut. Alfred B. Putnam, until April 30, 1903.

First Lieut. Paul Stanley Bond, from November 15, 1902, to January 8, 1903.

First Lieut. John H. Poole.

First Lieut. William A. Mitchell, since June 2, 1903.

COMPANY K.

Capt. Charles Keller, since April 1, 1903.

Capt. Charles W. Kutz, until March 14, 1903.

First Lieut. Albert E. Waldron, until March 24, 1903.

First Lieut. William P. Stokey, since April 11, 1903.

Second Lieut. Henry C. Jewett.

Second Lieut. Mark Brooke, September 30, 1902, to April 7, 1903.

Second Lieut. Warren T. Hannum, since June 2, 1903.

COMPANY L.

Capt. James F. McIndoe.

First Lieut. William Kelly, February 1 to April 24, 1903.

First Lieut. Edmund M. Rhett, until June 4, 1903.

First Lieut. Michael J. McDonough, until April 14, 1903.

First Lieut. Edward N. Johnston, since December 5, 1902.

Second Lieut. William L. Guthrie, since September 29, 1902.

COMPANY M.

Capt. Meriwether L. Walker.

First Lieut. Edward M. Adams, until January 21, 1903.

First Lieut. Albert E. Waldron, since March 25, 1903.

First Lieut. Paul Stanley Bond, since January 8, 1903.

First Lieut. William P. Stokey, until April 11, 1903.

Second Lieut. James F. Bell, since September 30, 1902.

During the year Companies K, L, and M of the Third Battalion took part in the combined Army and Navy maneuvers in the New London, Conn., artillery district, and were commended by the commanding general, Department of the East, for their work, which was entirely satisfactory in every respect. The battalion took part in the ceremonies attendant upon the laying of the corner stone of the building for the Army War College. On April 15, 1903, Companies I and K, under the command of Maj. Curtis McD. Townsend, left Washington Barracks, D. C., for San Francisco, Cal., en route to the Philippine Islands, reaching Manila, P. I., May 27, 1903, where they relieved Companies G and H of the Second Battalion of Engineers.

THE BOARD OF ENGINEERS.

The regulations for the government of the Corps of Engineers provide for a Board of Engineers, consisting of not less than three officers, designated by the Chief of Engineers with the sanction of the Secretary of War. This Board acts in an advisory capacity to the Chief of Engineers upon important questions of engineering. One of its principal duties is to plan or revise the projects for permanent fortifications of the United States.

The composition of this Board and its operations during the past fiscal year are given in its report.

(See Appendix No. 1.)

FORTIFICATIONS.

The scheme of national defense upon which work has now been in progress since 1888 is based upon a report dated January 16, 1886, submitted by the Board on Fortifications or other Defenses, popularly known as the Endicott Board. This Board indicated the localities where defenses were most urgently needed, determined the character and general extent of the defenses, with their estimated cost, and recommended for first consideration the names of 27 principal ports, arranged in the order of their importance.

The degree of defense to be provided for coaling and other naval stations scattered all over the world; for the larger naval bases which must be promptly established, and for which appropriations are asked of Congress by the Navy Department; for the ports of Manila, Pearl Harbor, and Honolulu, and for the lake ports and the St. Lawrence River, should preferably be determined by a tribunal similar to the Endicott Board, as recommended in my last annual report. (This tribunal should be created for the purpose by Congress, and, like the Endicott Board, should, it is suggested, include the Secretary of War, the Chiefs of Engineers, Ordnance, and Artillery, one high ranking officer of each of those branches of the service, two naval officers of high rank, and two civilians expert on the subject of our foreign commercial relations.) In the absence of legislation on the subject of insular defenses, a mixed board of engineer and artillery officers, organized by authority of the Secretary of War, has already partially considered and reported upon plans for the emergency defense of several of the most important harbors in the insular possessions. Valuable data have been collected regarding the physical character of the proposed sites, and when money becomes available work of construction can be started with reasonable promptness to provide a defense which will be adequate to emergencies in advance of the adoption of a more complete scheme of defense. Before these preliminary plans are actually entered upon, it might be well to invite the cooperation of the Navy by the assignment of a certain number of naval officers upon a new joint board of army and navy officers appointed to revise or enlarge the preliminary plans of defense heretofore prepared. For this purpose the Board might well assemble and conduct its labors in Washington, where the records are filed and the policy of the Government may be more easily determined.

The first act of Congress designed to carry out the recommendation of the Endicott Board was approved September 22, 1888. It created

the Board of Ordnance and Fortification and made appropriations for beginning the manufacture of modern seacoast ordnance, but made no provision for the construction of batteries. The first appropriation for the construction of gun and mortar batteries was contained in the act of August 18, 1890, since which time appropriations of varying amounts have been made regularly each year for carrying forward the adopted scheme of coast defense, for the manufacture of ordnance, for the construction of batteries, and for torpedo defenses.

From time to time the defensive details for each locality have been carefully elaborated in projects prepared by The Board of Engineers, and in each case these projects have received the formal approval of the Secretary of War prior to the actual beginning of work. Up to the present time projects for permanent seacoast defenses have been adopted for 31 localities in the United States, as follows:

- | | |
|---|--|
| 1. Frenchman Bay, Maine. | 16. Cape Fear River, North Carolina. |
| 2. Penobscot River, Maine. | 17. Charleston, S. C. |
| 3. Kennebec River, Maine. | 18. Port Royal, S. C. |
| 4. Portland, Me. | 19. Savannah, Ga. |
| 5. Portsmouth, N. H. | 20. St. Johns River, Florida. |
| 6. Boston, Mass. | 21. Key West, Fla. |
| 7. New Bedford, Mass. | 22. Tampa Bay, Florida. |
| 8. Narragansett Bay, Rhode Island. | 23. Pensacola, Fla. |
| 9. Eastern entrance to Long Island Sound. | 24. Mobile, Ala. |
| 10. New York, N. Y. | 25. New Orleans, La. |
| 11. Delaware River. | 26. Galveston, Tex. |
| 12. Baltimore, Md. | 27. San Diego, Cal. |
| 13. Washington, D. C. | 28. San Francisco, Cal. |
| 14. Hampton Roads, Virginia. | 29. Columbia River, Oregon and Washington. |
| 15. Entrance to Chesapeake Bay at Cape Henry. | 30. Puget Sound, Washington. |
| | 31. Lake Champlain. |

In addition to the above localities, the defense of the Great Lakes and the St. Lawrence River is under consideration.

Projects for the defenses for San Juan, Porto Rico; Pearl Harbor and Honolulu Harbor, Hawaii; San Luis d'Apra, Guam; Manila Bay, and Subic Bay have been approved by the Secretary of War, and actual construction should begin thereon at an early day. It is believed that the time has come when it will be no longer possible to ignore the question of insular defenses. The Navy Department is properly insistent that all its important coaling stations should receive proper defensive protection to keep off predatory attacks from possible hostile fleets.

The seacoast defenses of the United States are now somewhat more than 50 per cent completed. Twenty-five of the principal harbors of the United States have a sufficient number of heavy guns and mortars mounted to permit an effective defense against naval attack, and during the past three years considerable progress has been made in the installation of an adequate rapid-fire armament, now the matter of first importance.

Gun and mortar batteries.—The existing projects for seacoast defenses comprise 358 heavy guns of 8-inch, 10-inch, and 12-inch calibers, 1,294 rapid-fire guns from 2.24-inch to 6-inch caliber, and 532 mortars. The total cost for the engineering work is estimated at \$50,000,000, including what has been completed as well as what remains to be done.

Since the inauguration of the present system of coast defense the several appropriations made by Congress for the construction of gun and mortar batteries have been as follows:

Act of—		Act of—	
August 18, 1890	\$1, 221, 000. 00	May 7, 1898	\$3, 000, 000. 00
February 24, 1891	750, 000. 00	July 7, 1898	2, 562, 000. 00
July 23, 1892	500, 000. 00	March 3, 1899	1, 000, 000. 00
February 18, 1893	50, 000. 00	May 25, 1900	2, 000, 000. 00
August 1, 1894	500, 000. 00	March 1, 1901	1, 615, 000. 00
March 2, 1895	500, 000. 00	June 6, 1902	2, 000, 000. 00
June 6, 1896	2, 400, 000. 00	March 3, 1903	2, 236, 425. 00
March 3, 1897	3, 841, 333. 00		
Allotments from the appropriation for "National Defense," act of March 9, 1898.	3, 817, 676. 02	Total	27, 993, 434. 02

The total number of seacoast guns and carriages for which the Chief of Ordnance reports his department has made provision, and the corresponding permanent emplacements for which the Engineer Department has made provision with the funds appropriated for construction of gun and mortar batteries, including allotments from the appropriations for "National Defense," are shown in the following table:

Type of gun or carriage.	Total carriages provided.	Total emplacements provided.
12-inch mortar carriages, model 1896	a 306	296
12-inch mortar carriages, model 1891	b 85	80
12-inch disappearing carriages, L. F., model 1901	11	11
12-inch disappearing carriages, L. F., model 1897	35	35
12-inch disappearing carriages, L. F., model 1896	27	27
12-inch gun-lift carriages, altered to nondisappearing	3	3
12-inch gun-lift carriages, model 1891	2	2
12-inch nondisappearing carriages, model 1892	c 28	27
10-inch disappearing carriages, A. R. F., model 1896	3	3
10-inch disappearing carriages, L. F., model 1901	12	12
10-inch disappearing carriages, L. F., model 1896	74	74
10-inch disappearing carriages, L. F., model 1894	35	35
10-inch nondisappearing carriages, model 1898	d 11	9
8-inch disappearing carriages, L. F., model 1896	38	40
8-inch disappearing carriages, L. F., model 1894	26	26
8-inch nondisappearing carriages, model 1892	e 9	f 9
15-inch smoothbore carriages altered for 8-inch rifles	21	g 21
6-inch disappearing carriages, model 1898	29	29
6-inch rapid-fire (Vickers Son & Maxim), pedestal mounts	8	8
6-inch disappearing carriages, model 1903	70	70
6-inch rapid-fire, pedestal mounts, model 1900	44	44
5-inch balanced-pillar mounts, model 1896	32	32
5-inch pedestal mounts	21	21
4.7-inch rapid-fire (Armstrong pattern), pedestal mounts	34	34
4.7-inch rapid fire (Schneider pattern), pedestal mount	1	A 1
4-inch rapid-fire (Driggs-Schroeder), pedestal mounts	4	4
3-inch balanced-pillar mounts	118	118
3-inch casemate mounts	2	2
3-inch pedestal mounts	134	134
2.24-inch rapid-fire field carriages and rampart mounts	70	(i)

a The number of carriages of this type provided for exceeds by 10 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.

b One in use at West Point. 4 in storage.

c One in use at Sandy Hook Proving Ground.

d One at Sandy Hook Proving Ground. The number of carriages of this type provided for exceeds by 2 the number which the Chief of Engineers has notified the Chief of Ordnance are required for the emplacements he has provided.

e One at West Point and 1 at Sandy Hook Proving Ground.

f Five temporary. armament removed from 3.

g Temporary. armament removed from 20.

A Temporary.

i Movable mounts.

The foregoing table shows that up to the present time provision has been made for emplacing 334 heavy guns (including 26 temporary

emplacements), 567 rapid-fire guns (including 1 temporary emplacement), and 376 12-inch mortars.

During the fiscal year just closed operations were carried on with unexpended balances of the appropriations carried by the regular fortification appropriation acts approved May 25, 1900, March 1, 1901, and June 6, 1902. The number of emplacements provided for under each of the foregoing acts is exhibited in previous annual reports. Under the fortification act of March 3, 1903, it is proposed to provide emplacements for the following number of guns:

10-inch.	6-inch.	8-inch.
3	24	60

The total number of emplacements of every kind provided for to date by all appropriations is as follows:

12-inch.	10-inch.	8-inch.	Rapid-fire.	12-inch mortars.
105	133	96	567	376

In this total are included seventy 2.24-inch rapid-fire guns on movable mounts not requiring permanent emplacements, temporary emplacements for twenty-one 8-inch B. L. rifles on modified 15-inch carriages, one temporary emplacement for 4.7-inch rapid-fire gun, and five temporary emplacements for 8-inch guns on nondisappearing carriages. The foregoing temporary emplacements were built during the war with Spain from the "National Defense" funds. The 8-inch guns will be transferred from time to time to permanent emplacements as these are completed, and a number of them have already been so transferred. While it is proposed eventually to disarm these temporary emplacements, they can again be used in case of emergency, and have for this reason been included in the foregoing enumerations.

The status of emplacements for which funds have been provided by Congress is as follows at the close of the fiscal year:

	12-inch.	10-inch.	8-inch.	Rapid-fire.	12-inch mortars.
Guns mounted	92	115	a 93	b 178	328
Ready for armament.....	9	9	2	c 200	82
Under construction	4	8	1	189	16
Total	105	132	96	567	376

a Twenty-three of these, which have been mounted temporarily, have since been dismantled.

b One temporarily.

c Including seventy 6-pounders not requiring permanent emplacements.

At the close of the previous fiscal year there were reported mounted:

12-inch.	10-inch.	8-inch.	Rapid-fire.	12-inch mortars.
80	112	89	108	297

A comparison of the last two tables shows an addition during the year to the completed seacoast armament of twelve 12-inch guns, three 10-inch guns, four 8-inch guns, seventy rapid-fire guns, and thirty-one mortars.

For continuing the work of construction of gun and mortar batteries in accordance with approved projects an estimate of \$4,250,000 is submitted.

Range and position finders.—During the year satisfactory progress has been made. The utmost harmony has existed between the Chief of Engineers, the Chief of Ordnance, the Chief Signal Officer, and the Chief of Artillery, all of whose departments are involved in the work.

At the present time 11 fire commanders' and 55 battery commanders' stations have been completed and turned over to the troops for use and care; 22 fire commanders' and 55 battery commanders' stations are under construction.

The experimental system of position finding at Pensacola, using long horizontal bases, operated very satisfactorily under actual test. Final action by the Board of Ordnance and Fortification has not yet been taken on the test. An estimate of \$325,000 is submitted to continue the engineer work of installing range finders to serve batteries already built.

Preservation and repair of fortifications.—Operations under this appropriation have been limited during the fiscal year to the preservation of engineer material in new batteries, and to the application of remedial measures for reducing the dampness in some magazines in the earlier works. The mechanical and electrical appliances in modern batteries demand unremitting attention to prevent deterioration and damage under the destructive influence of the moist sea air. The new works already constructed represent an expenditure of approximately \$27,000,000 for engineering work alone. With the \$300,000 provided for by the act of March 3, 1903, for works of preservation and repair it will be possible to remedy many incipient leaks and other defects as well as to remove some faults of construction in the earlier emplacements. It is strongly recommended that an appropriation of the same sum be again made this year, as the needs are great and the number of separate batteries, etc., requiring attention and care is constantly increasing.

Supplies for seacoast defenses.—The acts of May 25, 1900, March 1, 1901, and June 6, 1902, each appropriated the sum of \$25,000, and that of March 3, 1903, \$35,000, for tools and electrical and engine supplies for use of the troops for maintaining and operating light and power plants in gun and mortar batteries. This is designed to enable the Engineer Department to meet the requirements of paragraph 382, Army Regulations, prescribing the articles which are to be supplied by the Engineer Department to the Coast Artillery for the service of the batteries. Requisitions are made directly upon the Chief of Engineers, and authorized articles are purchased and issued by district engineer officers with as little delay as possible. This system has proved satisfactory. An estimate of \$35,000 is submitted for this purpose for the next fiscal year. The sum carried by the last act has proved to be just sufficient for the purpose with the number of plants now in operation.

Sea walls and embankments.—The act of June 6, 1902, appropriated \$100,000 and that of March 3, 1903, \$89,575 for the construction of sea walls and embankments, which has been applied to the construction of sea walls at fortifications for the defense of the eastern entrance to Long Island Sound, New York Harbor, Delaware River, Baltimore, Md., Hampton Roads, Virginia, Tampa, Fla., Pensacola, Fla., Mobile, Ala., New Orleans, La., and San Diego, Cal.

Based upon reports of district engineer officers showing the necessity for their construction, an estimate of \$200,000 is submitted for the construction of sea walls and embankments at a number of additional localities.

Sites.—During the past year negotiations have been continued for the acquisition of one site at Boston Harbor, one at Narragansett Bay, and one at Fort St. Philip, La.; the acquisition of one site at Portland Harbor, Maine, was completed during the year. In addition, negotiations have been entered into for the acquisition of one site at Portland, Me., and one at the eastern entrance to Long Island Sound, and of one tract at Fort Hunt, Va.

A number of sites still remain to be acquired to carry out the approved projects of seacoast defenses, and an estimate of \$2,000,000 is submitted to continue the work. The most important of the sites still to be acquired is the one at the southern entrance to New York Harbor, rendered necessary by the new deep-water entrance now under construction.

Submarine mines.—With few exceptions all harbors are now equipped with torpedo storehouses, cable tanks, and serviceable mining casemates. Many of the latter are not of the latest type and are complained of by the artillery as insufficient in size. As funds become available they will be replaced by more convenient and commodious casemates. Additional mining casemates and storage facilities are still required at several localities; an estimate of \$225,000, to be expended under the Engineer Department, is submitted for their construction. The purchase of torpedo material proper, such as cables, cases, floating plant, etc., was, by act of June 6, 1902, assigned to the Artillery Corps, and the construction of the buildings, casemates, cable galleries, and cable tanks left with the Corps of Engineers.

By the army reorganization act of February 2, 1901, the torpedo defense of the seacoast devolved upon the artillery troops. The material has been reported ready for transfer at all points except Galveston, Tex.

Actual transfers have been made as follows:

Portland, Me., September 30, 1901.
 Portsmouth, N. H., December 16, 1901.
 Boston, Mass., January 5, 1903.
 New Bedford, Mass., November 15, 1901.
 Narragansett Bay, October 31, 1901.
 Eastern entrance to Long Island Sound, May 20, 1901.
 Eastern entrance to New York Harbor, July, 1901.
 Southern entrance to New York Harbor, May 6 and 14, 1901.
 Delaware River, July 13, 1901.
 Baltimore, Md., April 29, 1901.
 Washington, D. C., July 24, 1901.

Hampton Roads, Virginia, December 31, 1901.
 Cape Fear River, North Carolina, November 6, 1901.
 Charleston, S. C., May 2, 1901.
 Port Royal, S. C., July 26, 1901.
 Savannah, Ga., June 29, 1901.
 Key West, Fla., October 15, 1901.
 Tampa, Fla., August 17, 1901.
 Pensacola, Fla., May 27, 1901.
 Mobile, Ala., June 15, 1901.
 New Orleans, La., November 6, 1901.
 San Diego, Cal., May 31, 1901.
 San Francisco, Cal., April 1, 1903.
 Columbia River, April 30, 1901.

Searchlights and electrical connections.—The fortification appropriation act of March 1, 1901, appropriated \$150,000 for the purchase and installation of searchlights for the defenses of New York Harbor. Under this appropriation work is well advanced. The acts of June 6, 1902, and March 3, 1903, each appropriated \$150,000 for the general installation of searchlights in seacoast defenses.

The construction of the national seacoast defenses has now reached a point where most of the heavy guns are in position, and a large portion of the rapid-fire emplacements and some of the rapid-fire guns are completed, and it is important to continue the systematic installation of searchlight apparatus for night defense. Experience has shown that economy in installation and the keeping of electric plants in good order in time of peace are promoted by habitually using fortification plants for post illumination. An estimate of \$500,000 for searchlight installation is submitted and is recommended for special consideration as one of the urgent needs of the defense at this stage of its progress.

Defenses of insular possessions.—The importance of providing at an early date for the defenses of Porto Rico, the Hawaiian Islands, Guam, and the Philippines has been emphasized by the Chief of Engineers in his annual reports for the past three years, but up to the present time no funds for this purpose have been appropriated. Sufficient data are now on hand to permit beginning the construction of these defenses at once. An estimate of \$2,000,000 for the construction of gun and mortar batteries for the defense of these insular possessions is therefore submitted, to be applied at such insular localities as are now the property of the United States or may become so before the appropriation is exhausted. Sites for this purpose are now available at Porto Rico, Guam, and the Philippines, but the acquisition of additional land will be necessary for the defenses of the Hawaiian Islands. An estimate of \$526,100 is submitted for this purpose.

The following money statements show the actual expenditures during the fiscal year from the various appropriations for fortification work under the Engineer Department and the status, at the close of the fiscal year, of the unexpended balances of allotments:

“GUN AND MORTAR BATTERIES.”

For battery construction.

July 1, 1902, balances unexpended	\$1, 775, 966. 48
Net allotments during fiscal year	3, 209, 744. 57
Expenditures during fiscal year	4, 985, 711. 05
June 30, 1903, balances unexpended	3, 548, 357. 70
June 30, 1903, outstanding liabilities	\$247, 120. 13
June 30, 1903, covered by uncompleted contracts	210, 377. 37
	457, 497. 50
June 30, 1903, balances available	3, 090, 860. 20

For installation of range and position finders.

July 1, 1902, balances unexpended	\$149,590.83
Net allotments during fiscal year	396,016.61
Expenditures during fiscal year	545,607.44
	201,653.38
June 30, 1903, balances unexpended	343,954.06
June 30, 1903, outstanding liabilities	\$37,575.20
June 30, 1903, covered by uncompleted contracts	23,185.50
	60,760.70
June 30, 1903, balances available	283,193.36

"Searchlights for Harbor Defenses."

July 1, 1902, balances unexpended	30,533.72
Net allotments during fiscal year	217,998.96
Expenditures during fiscal year	248,532.68
	34,739.81
June 30, 1903, balances unexpended	213,792.87
June 30, 1903, outstanding liabilities	13,622.18
June 30, 1903, balances available	200,170.69

"Torpedoes for Harbor Defense."

July 1, 1902, balances unexpended	22,337.43
Net allotments during fiscal year	23,575.00
Expenditures during fiscal year	45,912.43
	30,312.85
June 30, 1903, balances unexpended	15,599.58
June 30, 1903, outstanding liabilities	1,378.05
June 30, 1903, balances available	14,221.53

"Siles for Fortifications and Seacoast Defenses."

July 1, 1902, balances unexpended	72,980.37
Net allotments during fiscal year	73,622.85
Expenditures during fiscal year	146,603.22
	36,716.75
June 30, 1903, balances unexpended	109,886.47
June 30, 1903, outstanding liabilities	28,800.00
June 30, 1903, balances available	81,086.47

"Preservation and Repair of Fortifications."

July 1, 1902, balances unexpended	45,712.89
Net allotments during fiscal year	365,866.54
Expenditures during fiscal year	411,579.43
	201,711.96
June 30, 1903, balances unexpended	209,867.47
June 30, 1903, outstanding liabilities	\$15,860.26
June 30, 1903, covered by uncompleted contracts	4,865.00
	20,725.26
June 30, 1903, balances available	189,142.21

16 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

"Supplies for Seacoast Defenses."

July 1, 1902, balances unexpended.....	\$10,860.05
Net allotments during fiscal year.....	41,272.24
Expenditures during fiscal year.....	52,132.29
	20,261.02
June 30, 1903, balances unexpended.....	31,871.27
June 30, 1903, outstanding liabilities.....	\$9,120.66
June 30, 1903, covered by uncompleted contracts.....	1,221.00
	10,341.66
June 30, 1903, balances available.....	21,529.61

"Sea Walls and Embankments."

July 1, 1902, balances unexpended.....	37,964.86
Net allotments during fiscal year.....	264,673.94
Expenditures during fiscal year.....	302,638.80
	73,859.05
June 30, 1903, balances unexpended.....	228,779.75
June 30, 1903, outstanding liabilities.....	\$9,696.41
June 30, 1903, covered by uncompleted contracts.....	34,985.82
	44,682.23
June 30, 1903, balances available.....	184,097.52

"Building, School of Submarine Defense."

July 1, 1902, balance unexpended.....	11,750.00
Expended during fiscal year.....	11,750.00

"Searchlights for New York Harbor."

July 1, 1902, balance unexpended.....	35,449.03
Expended during fiscal year.....	30,335.92
June 30, 1903, balance unexpended.....	5,113.11
June 30, 1903, outstanding liabilities.....	16.46
June 30, 1903, balance available.....	5,096.65

"Board of Ordnance and Fortification."

July 1, 1902, balance unexpended.....	7,829.00
Allotment during fiscal year.....	20,000.00
Expended during fiscal year.....	27,829.00
	7,829.00
June 30, 1903, balance unexpended and available.....	20,000.00

"Reconstruction and Repair of Fortifications, Galveston, Tex."

July 1, 1902, balance unexpended.....	788,129.02
Expended during fiscal year.....	267,013.07
June 30, 1903, balance unexpended.....	521,115.95
June 30, 1903, outstanding liabilities.....	\$31,285.04
June 30, 1903, covered by uncompleted contracts.....	155,976.20
	187,261.24
June 30, 1903, balance available.....	333,854.71

"Plans for Fortifications."

Allotted during fiscal year.....	5,000.00
Expenditures during fiscal year.....	5,000.00

ESTIMATES OF APPROPRIATIONS REQUIRED FOR 1904-5.

Fortifications.

For gun and mortar batteries:		
For construction of gun and mortar batteries.....	\$4, 250, 000	
For installation of range and position finders.....	325, 000	
		\$4, 575, 000
For sites for fortifications and seacoast defenses.....		2, 000, 000
For searchlights for harbor defenses		500, 000
For protection, preservation, and repair of fortifications.....		300, 000
For preparation of plans for fortifications		5, 000
For supplies for seacoast defenses		35, 000
For sea walls and embankments.....		200, 000
For torpedoes for harbor defense		225, 000
For defenses of insular possessions:		
For construction of seacoast batteries	\$2, 000, 000	
For procurement of land for sites for defenses of the		
Hawaiian Islands	526, 100	
		2, 526, 100
Total.....		10, 366, 100

POST OF WASHINGTON BARRACKS, D. C.

Under the command of Maj. William M. Black, Corps of Engineers, until April 1, 1903, and of Maj. Edward Burr, Corps of Engineers, since that date.

The reservation upon which this post is located is at the southern extremity of the city of Washington, D. C., and upon a long, narrow point lying between the Washington channel of the Potomac River and the James Creek Canal. A concise description of it will be found in the Annual Report, Chief of Engineers, 1902, page 793. The character of the buildings unsuited them for the uses of a garrison and their location was such as to render unavailable much of the area of the post, a large portion of which was subject to overflow at high tides and freshets. During the fiscal year much progress was made in improving the reservation by the reconstruction of sea walls and the raising of low lands by material dredged from the Washington channel. Plans were prepared for the entire reconstruction of the post, and the work was commenced under appropriations specifically made for that purpose. The construction of the War College building, at the southern end of the post, was also commenced.

Pending the completion of new buildings, only such ordinary repairs have been made to old barracks, quarters, and storehouses as to maintain them in fair condition for occupancy.

Water is obtained from the water supply of the city of Washington. The post is lighted by gas. There is no telegraph station upon the post, but telephonic communication is provided with the city. Mails are handled by special messenger to and from the nearest city substation.

There are no target facilities upon the post. A 200-yard range was used for a short time under special authority, but firing upon it had to be discontinued. A 300-yard range was prepared on the reservation of the Fort Foote subpost, and such target firing as could be done on this range and the Ordway rifle range was carried out. The range facilities for this post are entirely inadequate for efficient train-

ing of the troops, and the need of a Government range accessible to all troops near Washington is urgently felt.

The garrison of the post was composed of the Third Battalion of Engineers to April 15, 1903, and of Companies L and M of that battalion after that date. The engineer band was also stationed at the post.

SUBPOST OF FORT FOOTE.

Fort Foote is located on the left bank of the Potomac River about 7 miles below Washington Barracks. A concise description of it will be found in the Annual Report, Chief of Engineers, 1902, page 795. Under authority of the Secretary of War this reservation was placed under the command of the commanding officer of Washington Barracks for purposes of drill and target firing.

Fort Foote does not form a part of the existing project for the defense of the approaches to Washington, and the old defenses are in very bad condition. The existing buildings are old frame structures in bad repair and no garrison is maintained at the post, the reservation being in immediate charge of an ordnance sergeant. It was occupied from time to time during the summer of 1902 and during June, 1903, as a camp site for troops from this garrison while engaged in target firing or engineer drill upon the reservation.

No work was done on the reservation during the year, excepting minor repairs to the wharf, roads, and water supply. Additional repairs will be necessary, particularly to the water supply, in order to place the reservation in the proper condition for the use as a camp site for troops.

THIRD BATTALION OF ENGINEERS.

Under the command of Maj. William M. Black, Corps of Engineers, until April 1, 1903, and of Maj. Edward Burr, Corps of Engineers, since that date.

The Third Battalion of Engineers formed the garrison at Washington Barracks from the beginning of the year until April 15. On that date Companies I and K departed for San Francisco en route to the Philippines, under command of Maj. C. McD. Townsend, Corps of Engineers. Companies L and M are under orders to leave for the same destination on September 15, 1903. Companies K, L, and M were assigned to duty at Forts Wright and Terry during the combined Army and Navy maneuvers in August and September, 1902, and were engaged in operating searchlights and portions of the movable defenses, in addition to some engineering work in connection with the preparation of trenches and siege batteries.

The target firing of the command during the year was not all that could have been desired, due largely to insufficient range facilities, to which reference has been made in the report upon the post of Washington Barracks, D. C. Of the four men sent from the battalion to the department competition two men succeeded in gaining places upon the department team.

The full course of infantry and engineer instruction was carried on throughout the year, being varied to meet the conditions of summer and winter weather, and included many items of practical field instruction as well as theoretical instruction in post and noncommissioned

officers' schools during the winter. A detailed statement of this instruction will be found in the report of the commanding officer of the battalion. The battalion and all of its companies were provided with a full field equipment for service in the Philippines.

ENGINEER SCHOOL OF APPLICATION, U. S. ARMY.

Commandant, Maj. William M. Black, Corps of Engineers, until April 1, 1903, and Maj. Edward Burr, Corps of Engineers, since that date.

The staff of the school is composed of the commandant and 3 instructors detailed for that particular duty. Regular instruction of officers was begun on November 1, 1902, and was continued to April, 1903, when the school, so far as concerns instruction of officers, was suspended by the Secretary of War, on the recommendation of the War College Board and the Chief of Engineers, U. S. Army, these recommendations being based upon the great demand for engineer officers for duty elsewhere and the necessity of vacating the old buildings in order to make room for the new ones in process of erection. During the year 16 officers of the Corps of Engineers were under instruction. A statement of the method of instruction followed will be found in the Annual Report, Chief of Engineers, 1902, and the details of the course during the past year will be found in the report of the commandant. The school is composed of three principal departments for instruction in military engineering, civil engineering, and electrical and mechanical engineering, and the course includes theoretical instruction during the winter season and practical instruction between May 1 and November 1. A trade school is also maintained for the instruction of enlisted men in a number of the mechanical trades.

At the beginning of the fiscal year and following the transfer of the school from Willets Point, N. Y., to this post, the school was lacking in nearly all the items of equipment necessary for successful operation. A large part of the essential elements of equipment for offices, class rooms, laboratories, and shops was provided during the year from the appropriation made for the school. Besides the furniture and supplies needed for office equipment and for maintenance the principal improvements during the year were in the electrical laboratory and the trade-school shops.

In addition to their regular duties much work in other lines was done by the officers on duty with the school, including a consideration of the improvement of the engineer equipment of troops, the improvement of the bridge equipage, and the preparation of the Engineer Field Manual. Four pamphlets, the text of which was prepared by officers on duty with the school, were printed upon the school press and distributed.

ENGINEER DEPOT, WASHINGTON BARRACKS, D. C.

In charge of Maj. William M. Black, Corps of Engineers, until April 1, 1903, and of Maj. Edward Burr, Corps of Engineers, since that date.

The Engineer Depot, located at Washington Barracks, D. C., has been largely employed during the year in the purchase and issue of

equipment for engineer troops, the repair and issue of engineer instruments, the purchase of intrenching tools, and the improvement of the ponton equipage. The routine work of the depot includes, moreover, the care and preservation of a large number of tools and instruments stored at the depot or received and issued from time to time.

The facilities for carrying on the work of the depot at this post have been very meager, particularly in the way of storage facilities. No suitable building for an engineer storehouse has been available since the transfer of this depot from Willets Point, New York Harbor, in October, 1901, and the depot property has been stored in various buildings, which have been temporarily arranged and repaired for the purpose. Many minor repairs and alterations were made to old buildings during the year, but suitable facilities will not be available until the completion of the reconstruction of the post of Washington Barracks. Details of the work of the depot will be found in the report of the officer in charge.

STATEMENT OF FUNDS.

I. For Engineer Depot at Willets Point, N. Y., for fiscal year ending June 30, 1902, for "Washington Barracks:"			
July 1, 1902, balance unexpended.....			\$283. 44
June 30, 1903, expended during fiscal year.....	\$278. 51		
June 30, 1903, turned into the Treasury	4. 93		
			<u>283. 44</u>
II. For Engineer Depot, fiscal year ending June 30, 1903:			
Amount allotted			8, 000. 00
June 30, 1903, expended during fiscal year.....	\$7, 366. 64		
June 30, 1903, amount pledged.....	633. 36		
			<u>8, 000. 00</u>
III. Engineer School, Washington, D. C., 1903:			
Amount appropriated for fiscal year ending June 30, 1903.....			45, 000. 00
June 30, 1903, amount expended during fiscal year.....	\$24, 263. 87		
June 30, 1903, amount pledged.....	20, 486. 12		
June 30, 1903, available for contingent expenses attending the completion of contracts	250. 01		
			<u>45, 000. 00</u>
IV. Equipment of Engineer Troops, fiscal year 1902:			
July 1, 1902, balance unexpended.....			494. 32
June 30, 1903, expended during fiscal year.....	\$372. 50		
June 30, 1903, turned into the Treasury.....	121. 82		
			<u>494. 32</u>
V. Engineer equipment of troops, fiscal year 1903:			
Total of allotments made during fiscal year.....			8, 787. 19
June 30, 1903, expended during fiscal year.....	\$5, 887. 56		
June 30, 1903, amount pledged.....	2, 899. 53		
June 30, 1903, to be turned into the Treasury.....	. 10		
			<u>8, 787. 19</u>
VI. Emergency fund, War Department, act of March 3, 1899, for "Equipment of Electrical Laboratory at Engineer School, Washington Barracks:"			
July 1, 1902, balance unexpended.....			5, 950. 91
June 30, 1903, expended during fiscal year.....	\$4, 939. 99		
July 1, 1903, balance unexpended.....	1, 010. 92		
			<u>5, 950. 91</u>

VII. Examinations, Surveys, and Contingencies of Rivers and Harbors, for
 "Repairs of Instruments:"

Amount allotted during fiscal year		\$500. 00
June 30, 1903, expended during fiscal year.....	\$491. 40	
June 30, 1903, amount pledged.....	8. 60	
		500. 00

NEW APPROPRIATIONS.

I. For Engineer Depot, for fiscal year ending June 30, 1904, the following amounts were allotted by the Chief of Engineers, United States Army:

a. For "Incidentals"	\$8, 000. 00	
b. For "Instruments"	500. 00	
		\$8, 500. 00

For Engineer Equipment of Troops, for fiscal year ending June 30, 1904

5, 400. 00

II. For Engineer School, Washington, D. C., for fiscal year ending June 30, 1904:

Amount appropriated for equipment and maintenance of the Engineer School of Application at Washington Barracks, D. C. 25, 000. 00

(See Appendix No. 2.)

ENGINEER DEPOT, FORT LEAVENWORTH, KANS.

This depot is maintained for the purpose of storing and issuing supplies for the First Battalion of Engineers, and for the storage of the surplus ponton materials. It is under the charge of Maj. Smith S. Leach, Corps of Engineers, commanding First Battalion of Engineers.

During the year additional ponton material has been purchased, and repairs have been made to that on hand.

The reproduction of plates in connection with the Engineer Field Manual has also been in progress.

The additional operations of the depot have consisted in the purchase of photographic and drafting supplies, tools and supplies for the First Battalion of Engineers, and equipment for the engineer shop of instruction.

Details of expenditures are shown in the report of the officer in charge.

(See Appendix No. 3.)

ENGINEER DEPOT, NEW YORK CITY.

Officer in charge during the fiscal year, Lieut. Edward H. Schulz, Corps of Engineers.

The Engineer Depot at Willets Point, N. Y., was closed on June 30, 1902, and transferred to Army Building, New York City. All property was disposed of by transfer and condemnation. Final return for the Willets Point Depot was rendered December 31, 1902.

During the year purchases of engineering supplies of all kinds were made for the engineer equipment of troops; and instruments were purchased and repaired for use of engineer officers in charge of districts and department and division engineers.

Such purchases of submarine mining material as were authorized by the Chief of Engineers were made. On February 21, 1903, in accordance with instructions received from the Chief of Engineers, the unexpended balance of funds on account of allotments from appropriation "Torpedoes for Harbor Defense," for purchase of submarine mining materials, etc., was deposited to the credit of the appropriation.

On December 11, 1902, a test of the Engelhardt collapsible lifeboat was witnessed at the New York Navy-Yard, and report submitted thereon to the Chief of Engineers on December 19, 1902.

Six sketching cases were manufactured on the Bower plans and specifications, and two issued to each of the three battalions of engineers for test.

Six sketching boards were manufactured on the McGregor-Harts plans and specifications, and two issued to each of the three battalions of engineers for test.

The total number of instruments repaired and average cost of same were as follows:

	Number.	Total cost.	Average cost.
Transits	78	\$3,260.85	\$41.81
Levels	53	1,132.15	21.36
Sextants	15	438.15	29.21
Miscellaneous instruments	91	1,044.80	11.48
Total	237	5,875.95	.....

Engineering and surveying supplies purchased and shipped during the fiscal year:

United States:

Engineer officers of departments	\$2,136.72
Post engineer officers	1,266.79
Engineer officers of districts	46.20
First Battalion of Engineers	741.18
Third Battalion of Engineers	101.33
Engineer Depot, Washington Barracks, D. C.	1,008.60
State militia	46.82
Balance of United States	589.07
Alaska	14.72
Cuba	19.35
Porto Rico	12.00
Philippine Islands (including Second Battalion of Engineers)	3,292.87
China	10.95
Total	9,286.60

I. Torpedoes for Harbor Defense, act March 1, 1901, for "Purchase of Submarine Mining Materials, etc.:"

July 1, 1902, balance unexpended	2,075.39
June 30, 1903, amount expended during fiscal year	\$671.33
February 21, 1903, amount deposited to credit of Treasurer United States	1,404.06
	2,075.39

II. Engineer Equipment of Troops, 1903, act June 30, 1902:

June 30, 1903, total of allotments received	10,323.05
June 30, 1903, amount expended during fiscal year	10,323.05

III. Engineer Equipment of Troops, 1903, act June 30, 1902, "Purchase and Repair of Instruments:"

November 7, 1902, amount allotted	625.00
June 30, 1903, amount expended during fiscal year	625.00

IV. Engineer Depot, 1903:

1. Act June 30, 1902, for "Instruments"—	
July 10, 1902, amount allotted	2,500.00
June 30, 1903, amount expended during fiscal year	2,500.00
2. For "Incidentals"—	
December 4, 1902, amount allotted	416.69
June 30, 1903, amount expended during fiscal year	416.69

V. Examinations, Surveys, and Contingencies of Rivers and Harbors,

"Purchase and Repair of Instruments:"

June 30, 1903, total of allotments received.....	\$1,750.00
June 30, 1903, amount expended during fiscal year.....	1,301.98

July 1, 1903, balance available	448.02
---------------------------------------	--------

VI. Gun and Mortar Batteries, act of June 6, 1902. "Purchase and repair of instruments:"

June 30, 1903, total of allotments received.....	\$1,125.00
June 30, 1903, amount expended during fiscal year	616.73

July 1, 1903, balance available	508.27
---------------------------------------	--------

(See Appendix No. 4.)

ESTIMATES OF APPROPRIATIONS REQUIRED FOR THE ENGINEER DEPOTS
FOR 1904-5.

For incidental expenses of the depots, including fuel, lights, chemicals, stationery, hardware, machinery, pay of civilian clerks, mechanics, and laborers, extra-duty pay to soldiers necessarily employed for periods not less than ten days as artificers on work in addition to and not strictly in the line of their military duties, such as carpenters, blacksmiths, draftsmen, printers, lithographers, photographers, engine drivers, telegraph operators, teamsters, wheelwrights, masons, machinists, painters, overseers, and laborers; repairs of and for materials to repair public buildings and machinery, and for unforeseen expenses.....	\$11,500
For purchase and repair of instruments to be issued to officers of the Corps of Engineers and to officers detailed and on duty as acting engineer officers, for use on public works and surveys	5,000
Total	16,500

ENGINEER EQUIPMENT OF TROOPS AND CIVILIAN
ASSISTANTS TO ENGINEER OFFICERS.

By act of Congress approved June 30, 1902, the sum of \$25,000 was appropriated for the equipment of engineer troops in the field, for the procurement of ponton trains, intrenching tools, instruments, drawing materials, etc., and the sum of \$25,000 for civilian assistants to engineer officers serving on the staffs of division, corps, and department commanders to enable them to secure the employment of surveyors, draftsmen, photographers, master laborers, and clerks. Both appropriations were limited to the fiscal year 1903.

With the funds appropriated for the purposes above stated engineering supplies were furnished mainly through the United States engineer depots for the various military departments in the United States, the Philippines, and Porto Rico, and the several engineer officers attached to important military commands and departments have been supplied with the necessary civilian assistants. Under the act \$24,999.90 was allotted from the equipment appropriation, and a balance of 10 cents reverted to the Treasury. From the appropriation for civilian assistants \$21,428.46 was allotted, and a balance of \$3,571.54 reverted to the Treasury.

The army appropriation act of March 2, 1903, provided \$25,000 for the engineer equipment of troops and \$25,000 for civilian assistants to engineer officers for the fiscal year ending June 30, 1904.

The engineer troops are now practically provided with their own ponton equipment. The sum of \$75,000 is estimated as required for the engineer equipment of troops for the next fiscal year. With this

amount, if appropriated, it is designed to repair and maintain the existing ponton equipment and to procure one ponton train, consisting of four divisions, at an estimated cost of \$50,000, as a reserve for volunteer engineer troops in time of war and for maneuvers.

The sum of \$25,000 is requested for civilian assistants to engineer officers for the next fiscal year.

For details of expenditures under these appropriations see Appendixes Nos. 2, 3, 4, and H H H.

SERVICE OF OFFICERS OF THE CORPS OF ENGINEERS
ABROAD AND IN THE FIELD, WITH TROOPS, JULY 1,
1902, TO JUNE 30, 1903.

LIEUT. COL. CHARLES E. L. B. DAVIS.

July 1, 1902, to June 30, 1903.—Engineer officer, Division of the Philippines. Senior member of Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands.

October 15, 1902.—President of Board of officers for the examination for promotion of certain officers of the Corps of Engineers.

December 29, 1902.—Member of Board of officers to investigate the circumstances of the grounding of the transport *Sherman* in San Bernardino Straits on December 26, 1902, and to fix the responsibility therefor.

LIEUT. COL. CLINTON B. SEARS.

July 1, 1902, to May 7, 1903.—Commanding Second Battalion of Engineers. Disbursing officer for the office of the engineer officer, Division of the Philippines. In charge of the improvement of the harbor of Manila and the Pasig River.

October 15, 1902.—Member of Board of officers for the examination for promotion of certain officers of the Corps of Engineers.

November, 1902.—Member of committee to prepare plan and estimate for demolition of part of the old Spanish enciente, parallel to and adjoining the south bank of the Pasig River, and the protection of the ground thus acquired by a sea wall.

December, 1902.—In consultation with the civil governor as to an additional breakwater for Manila Harbor and the necessity of establishing harbor lines in the Pasig River.

January 3, 1903.—Member of Board of survey to make inventory and return for property for which Capt. Robert McGregor, Corps of Engineers, was responsible at the time of his death.

January 9, 1903.—Ex officio member of commission to establish harbor lines in the port of Manila and the Pasig River.

May 7, 1903.—Relieved from duty in the Division of the Philippines and left Manila on board transport *Sheridan* for Japan, on leave of absence.

MAJ. CURTIS M'D. TOWNSEND.

May 27, 1903.—Arrived at Manila, P. I., on transport *Thomas*, in command of Companies I and K, Third Battalion of Engineers, and assumed command of Companies E and F, Second Battalion of Engineers.

May 28, 1903.—Assigned to the charge of the harbor improvements of the port of Manila and of the Pasig River, and as disbursing officer, office of the engineer officer, Division of the Philippines.

June 15, 1903.—Member of Board of officers for the examination for promotion of certain officers of the Corps of Engineers.

CAPT. HENRY JERVEY.

July 1, 1902, to June 30, 1903.—Light-house engineer Philippine Archipelago. Assistant to the engineer officer, Division of the Philippines. Member of Board of officers to consider and report upon the subject of the defense of the important harbors of the Philippine Islands. Member of committee to make inventory of Government property in the province of Cavite.

October 15, 1902.—Member of Board of officers for the examination for promotion of certain officers of the Corps of Engineers.

May, 1903.—In charge of the construction of a 1,400-ton marine railway, under the direction of the chief of the bureau of coast guard and transportation.

CAPT. WILLIAM W. HARTS.

July 1, 1902.—Commanding Company H, Second Battalion of Engineers; commanding engineer garrison of Manila; member of Board of officers to determine the project for the establishment of a new post near Manila (Fort William McKinley), and in charge of preliminary work of construction at the post.

July 1 to September 30, 1902.—Engineer officer on the staff of the commanding general Department of North Philippines.

July 21 to September 2, 1902.—On leave of absence in Japan.

September 6 to December 30, 1902.—Commanding garrison of Cuartel de Malate.

September 30, 1902, to June 3, 1903.—Engineer officer on the staff of the commanding general Department of Luzon.

October, 1902.—Member of Board of officers for the establishment of a post and prison at Malahi Island.

October 10, 1902.—Member of Boards of officers for the establishment of new posts at Corregidor Island and at Mariveles, Bataan Province.

January 20, 1903.—In charge of survey of post site at Bayambang, Pangasinan Province.

February, 1903.—In charge of survey of military lands within the limits of Manila, under orders of the division commander.

March 5, 1903.—Member of Board of officers for the examination for promotion of certain officers of the Signal Corps.

April, 1903.—In charge of preliminary work on construction of new post at Los Banos.

May 7-28, 1903.—Commanding Second Battalion of Engineers.

June 14, 1903.—Sailed from Manila on board transport *Thomas* in command of Companies G and H, Second Battalion of Engineers.

CAPT. ROBERT M'GREGOR.

July 1, to December 23, 1902.—Sanitary engineer for the Philippine Islands and engineer of the city of Manila.

November, 1902.—Member of committee to prepare plan and estimate for the demolition of part of the old Spanish enciente, parallel to and adjoining the south bank of the Pasig River, and the protection of the ground thus acquired by a sea wall.

December 23, 1902.—Died at Manila, Philippine Islands.

CAPT. CHARLES KELLER.

May 27, 1903.—Arrived in Manila, P. I., on transport *Thomas*, commanding Company I, Third Battalion of Engineers.

May 29, 1903.—Member of Board of officers to examine into, report upon, and fix responsibility for the grounding of United States army transport *Seward* off the northwest coast of island of Panay on the night of April 24, 1903.

June 6, 1903.—Member of Board of officers to examine and report upon the collision of a casco with pier of Alaya Bridge on October 13, 1902, and to estimate damage to bridge.

June 11, 1903.—Engineer officer, Department of Mindanao.

CAPT. SPENCER COSBY.

May 27, 1903.—Arrived in Manila, P. I., on transport *Thomas*, commanding Company I, Third Battalion of Engineers.

June 3, 1903.—Engineer officer department of Luzon.

June 3, 1903.—Member of Board of officers to consider and determine project for the establishment of military post near Manila (Fort William McKinley), vice Captain Harts, relieved.

June 8, 1903.—Turned over to the treasurer of the Philippine Islands the new Philippine coinage received from the superintendent of the United States mint at San Francisco, Cal. Member of Board of officers to investigate and report upon the claim of Felipe Zamora for rent and alleged damages to property occupied by the Government and claimed by him.

CAPT. JAY J. MORROW.

July 1, 1902.—Commanding Company G, Third Battalion of Engineers.

July 1 to September 30, 1902.—Engineer officer Seventh Separate Brigade.

October 1, 1902, to June 3, 1903.—Engineer officer Department of Mindanao. Assistant quartermaster, United States Army, in connection with construction of Iligan Lanao road. In charge of construction of roads near Malabang and from Cottabato to Davao. In charge of construction and repair of wharf at Iligan and of wharves at Jolo and Parang. In charge of installation of anchorage appliances for Zamboanga wharf.

October to November 26, 1902.—Engineer officer expedition against the Lake Lanao Moros.

LIEUT. LYTLE BROWN.

July 1, 1902.—Attached to Company F, Second Battalion of Engineers.

July 1 to October 14, 1902.—In charge of survey and of preparation of project for improvement of Cagayan River, Luzon.

September 17, 1902.—Relieved from duty in the Division of the Philippines and ordered to proceed to Washington, D. C., and report to the Chief of Engineers for orders.

October 31, 1902.—Sailed from Manila on board transport *Crook*.

LIEUT. EARL I. BROWN.

July 1 to October 8, 1902.—In command of Company F, Second Battalion of Engineers.

July 1 to September 30, 1902.—Assistant engineer officer, Department of South Philippines.

September 25 to October 4, 1902.—On detached service at Camp Vicars.

September 25–26, 1902.—Engineer officer on expedition against hostile Moros near Lake Butig, south of Lake Lanao.

October 19, 1902.—Engineer officer, Department of the Visayas. In charge of the property and records of the office of the engineer officer, Department of South Philippines.

November 25, 1902.—Assumed command of Company F, Second Battalion of Engineers, at Iloilo, Department of the Visayas.

January, 1903.—In charge of survey of Iloilo Harbor with a view to making plans and estimates for the improvement thereof, and in charge of building roads and bridges on the island of Panay.

February, 1903.—Directing certain road work on the islands of Guimaras and Panay, making surveys of the proposed sites for military posts at Camp Jossman, Guimaras, and at Ormac, Leyte, and making maps of the department.

May, 1903.—Member of Board of officers to visit, report upon, and assist in all construction work in connection with establishment of army posts throughout the Department of the Visayas.

LIEUT. AMOS A. FRIES.

July 1 to December 6, 1902.—In command of a detachment of 45 men of Company G, Second Battalion of Engineers, building a wharf at Zamboanga, and discharge of engineer office Seventh Separate Brigade in the absence of Capt. Jay J. Morrow, Corps of Engineers.

September 10–29, 1902.—On duty in the field in the vicinity of Camp Vicars making a map of Lake Lanao, Mindanao, and on one expedition lasting five days against the Lake Lanao Moros as engineer officer of the expedition.

December 6, 1902, to March 4, 1903.—Constructing wharf at Jolo, Jolo, P. I., preparing plans for wharf at Siasi, Siasi, P. I., and investigating with view to improvement of water supply of Jolo, Jolo.

March 12 to April 25, 1903.—Sick in First Reserve hospital, Manila.

April 26 to May 18, 1903.—On temporary duty with Company H, Second Battalion of Engineers.

May 19, 1903.—Commanding Company G, Second Battalion of Engineers.

May 28–30, 1903.—On temporary special duty making an accurate survey of Mariveles quarantine station Mariveles, Bataan, Luzon, P. I.

June 14, 1903.—Sailed from Manila on transport *Thomas* with Company G, Second Battalion of Engineers.

LIEUT. JAMES A. WOODRUFF.

July 1, 1902.—Adjutant Second Battalion of Engineers, ordnance, signal, and recruiting officer, and acting quartermaster and commissary of the Second Battalion of Engineers and the engineer garrison, post of Manila. Adjutant and summary court officer of the engineer garrison until July 19, 1902. In charge of the photographic laboratory of the office of the engineer officer of the Division of the Philippines. In charge of the instruction of Companies E and H, Second Battalion of Engineers, in photography.

July 1 to September 6, 1902.—Commanding engineer garrison of Manila.

July 19–31, 1902.—Acting engineer officer, Department of North Philippines.

July 31 to August 8, and August 22 to September 6, 1902.—In charge of the engineer office, Department of North Philippines.

November 7 to December 2, 1902.—With a detachment of 6 enlisted men engaged in making survey of site of new post at Laguan, Samar, and the preparation of plans and estimates for a wharf at the same place.

December 2, 1902.—Adjutant engineer garrison of Manila.

December 2–31, 1902.—Adjutant Cuartel de Malate.

December, 1902, to January 15, 1903.—Instructor of field engineering and military topography and sketching, officers' school, Cuartel de Malate.

January 7–13, 1903.—Member of party sent on transport *Ingalls* to locate rock on which transport *Sherman* struck in San Bernardino Straits on December 26, 1902.

March 14 to April 2, 1903.—Engaged in the exploration of the Mariveles Military Reservation with a view to the selection of a suitable site for a hospital and recuperation post above the 2,500-foot level, and also the location of a practicable wagon road to the site.

May 30, 1903.—Relieved of all duties except adjutant, Second Battalion of Engineers, by Lieutenant Adams.

June 14, 1903.—Sailed from Manila on transport *Thomas*, with Companies G and H, Second Battalion of Engineers.

LIEUT. WILLIAM KELLY.

July 1, 1902.—Ordered to proceed to Iloilo, Panay, P. I., to assume charge of the survey, project, and estimate for the improvement of Iloilo Harbor.

July 18, 1902.—At Iloilo, Panay.

July 29, 1902.—Engineer officer Fifth Separate Brigade.

September 17, 1902.—Relieved from duty in the Division of the Philippines.

September 24, 1902.—Left Iloilo.

October 1 to November 30, 1902.—En route from Manila, P. I., to New York City on board the transport *McClellan*, via Suez Canal.

LIEUT. LEWIS H. RAND.

July 1, 1902.—On duty with Company H, Second Battalion of Engineers. Engaged on road and bridge work near Dagupan, Pangasinan.

July 31, 1902.—Abolished office at Dagupan, work having been completed, and changed station to Malate, Manila, P. I.

August 1-22, 1902.—Commanding Company H, Second Battalion of Engineers.

August 9 to September 9, 1902.—Acting engineer officer, Department of North Philippines.

August 22 to November 26, 1902.—Engaged on preliminary survey of sites for contemplated new stations at Arayat and Angeles, Panganga, Luzon, P. I.

December 8, 1902.—Transferred to Company G, Second Battalion of Engineers, and assumed command at Iligan, Mindanao.

May 18, 1903.—Brought Company G to Manila and transferred to Company H, Second Battalion of Engineers.

June 4, 1903.—Temporarily relieved from duty with Company H and attached to Company F, Second Battalion of Engineers.

LIEUT. EDWARD M. MARKHAM.

July 1, 1902.—Quartermaster and commissary, Second Battalion of Engineers.

July 1, 1902, to April 13, 1903.—In local charge of preliminary work of construction of Fort William McKinley.

April 13 to May 4, 1903.—Investigating titles to certain coal lands in island of Batan and securing options for their purchase by the United States from the claimants.

May 28, 1903.—Relieved from duty as quartermaster and commissary, Second Battalion of Engineers, by Lieutenant Adams.

June 14, 1903.—Sailed from Manila, on transport *Thomas*, with Companies G and H, Second Battalion of Engineers.

LIEUT. GEORGE B. PILLSBURY.

July 1, 1902, to January 31, 1903.—In charge of the engineer work in the Third Brigade, Division of the Philippines, including the construction of a road from Calamba to Batangas and of road from Bay to San Pablo, and surveys and estimates of proposed sites for military posts at Calamba, Los Banos, Santo Tomas and Batangas.

February 10, 1903.—On special duty under the chief engineer, Division of the Philippines, measuring and marking areas for the batteries, their garrisons, and water supply on the north and south shores of the entrance to Manila Bay.

May 7, 1903.—Rejoined Company E, Second Battalion of Engineers, and left Manila with company.

May 12, 1903.—Arrived at Iligan, Mindanao.

May 13, 1903.—Relieved Lieutenant Rand of the charge of the Iligan-Lake Lanao military road.

May 17, 1903.—The company marched to Camp Pantar, at the head of the work on the road. Engaged in supervising the engineer work on the road and the construction of the suspension bridge over the Argus River.

LIEUT. EDWARD M. ADAMS.

May 27, 1903.—Arrived at Manila, P. I., on transport *Thomas*, acting adjutant, quartermaster, and commissary, Companies I and K, Third Battalion of Engineers.

May 28, 1903.—Quartermaster and commissary, Companies E and F, Second Battalion of Engineers, and Companies I and K, Third Battalion of Engineers.

May 30, 1903.—Adjutant, ordnance, signal, recruiting, intelligence, and summary court officer, engineer garrison of Manila.

June 6, 1903.—Quartermaster and commissary of the engineer garrison of Manila.

LIEUT. GUSTAVE R. LUKESH.

July 1 to December 8, 1902.—In charge of road and bridge work in provinces of Cagayan, Isabela, and Nueva Viscaya. Commanding detachment of Company E, Second Battalion of Engineers.

December 9-16, 1902.—En route to Manila.

December 17, 1902.—Reported at Cuartel de Malate and assigned to temporary command of Company E, Second Battalion of Engineers. Commanding Company E until April 7, 1903.

January 7-14 and March 14 to April 2, 1903.—Adjutant and summary court officer of engineer garrison, acting adjutant, ordnance, signal, and recruiting officer, acting quartermaster and commissary, Second Battalion of Engineers, and in charge of the photographic laboratory of the office of the engineer officer of the Division of the Philippines.

February 1 to April 11, 1903.—Engaged on survey of military lands in Manila.

April 8, 1903.—In local charge of the preliminary work of construction of Fort William McKinley. Engaged in the construction of roads, grading sites for barracks, supervision of the drilling by contract of artesian wells, and of construction by contract of eight infantry barracks.

June 14, 1903.—Sailed from Manila on transport *Thomas* en route for the United States.

LIEUT. JOHN R. SLATTERY.

July 1-9, 1902.—At Manila, P. I., in charge of repairs to roads in the vicinity of Manila, P. I.

July 9 to September 17, 1902.—In command of Company E, Second Battalion of Engineers.

July 19 to September 2, 1902.—Summary court officer, engineer garrison of Manila, during absence of Captain Harts.

July to September, 1902.—In charge of a survey of the military lands in Manila and of road work near Pasay.

September 17, 1902.—Relieved from duty in the Division of the Philippines.

October 1, 1902.—Sailed from Manila on transport *McClellan* for New York City via the Suez Canal.

LIEUT. CURTIS W. OTWELL.

July 1, 1902, to June 30, 1903.—Attached to Company F, Second Battalion of Engineers. Engaged in preparing project, plans, and estimates and in construction of pier at Calbayog, Samar, P. I.

LIEUT. HUBERT L. WIGMORE.

July 1 to August 5, 1902.—Attached to Company G, Second Battalion of Engineers. Sick in hospital at Zamboanga.

August 5 to September 30, 1902.—Aid-de-camp on the staff of the commanding general, Department of North Philippines.

September 30, 1902.—Aid-de-camp on the personal staff of the commanding general, Division of the Philippines.

December 29, 1902.—Recorder of Board of officers to investigate the circumstances attending the grounding of the transport *Sherman* in San Bernardino Straits on December 26, 1902, and to fix the responsibility therefor.

February 11 to June 19, 1903.—In charge of clerks and messengers and in command of detachment of enlisted men at headquarters, Division of the Philippines.

February 11 to June 19, 1903.—Recorder of Board of officers to consider and determine the project, in all its details, of the establishment of a military post near the city of Manila.

June 19, 1903.—Detailed on special duty in the Quartermaster's Department and assigned to the work of developing and working the Government coal deposits on Batan Island, province of Albay.

LIEUT. WILLIAM P. STOKEY.

May 27, 1903.—Arrived at Manila, P. I., on transport *Thomas*, with Company I, Third Battalion of Engineers.

June 15, 1903.—On duty in connection with certain surveys under the direction of the commanding general Third Brigade.

LIEUT. EDWARD N. JOHNSTON.

July 2-25, 1902.—Sick in quarters.

July 26 to August 10, 1902.—Sick in First Reserve hospital.

August 11 to September 12, 1902.—Sick in quarters.

September 13-20, 1902.—On duty with Company E, Second Battalion of Engineers.

September 21-30, 1902.—Sick in First Reserve hospital.

October 1-31, 1902.—En route from Manila to San Francisco, Cal., on transport *Sheridan*.

LIEUT. CLARENCE O. SHERRILL.

July 1-6, 1902.—In charge of road and bridge work at San Fernando, Pampanga, in command of detachment of engineer troops.

July 7-20, 1902.—At Manila, P. I., commanding Company H, Second Battalion of Engineers.

July 21 to August 23, 1902.—On duty with Company H, Second Battalion of Engineers.

August 23 to October 11, 1902.—At Bayambang, Pangasinan, surveying regimental post.

October 20-25, 1902.—At Mariveles, Bulacan, surveying two-company post.

November 1 to December 19, 1902.—Commanding Company E, Second Battalion of Engineers.

November 7 to December 2, 1902.—Acting adjutant Second Battalion of Engineers, adjutant Cuartel de Malate, summary court officer, adjutant of engineer garrison of Manila.

January 5-31, 1903.—Sick in hospital, Manila.

February 4 to May 15, 1903.—In charge of wharf construction at new military post near Iligan, Mindanao, and of truss bridge across Nanucan River.

May 15-18, 1903.—On duty with Company G, Second Battalion of Engineers.

May 18, 1903.—On duty with Company H, Second Battalion of Engineers.

LIEUT. JOHN H. POOLE.

May 27, 1903.—Arrived at Manila, P. I., on transport *Thomas*, with Company I, Third Battalion of Engineers.

May 27, 1903.—Assigned to special duty in the office of the adjutant-general, Division of the Philippines.

June 19, 1903.—Assigned to command of detachment of enlisted men at headquarters, Division of the Philippines.

June 19, 1903.—Recorder of Board of officers to consider and determine the project, in all its details, for the establishment of a military post near the city of Manila.

LIEUT. ERNEST D. PEEK.

July 1, 1902.—On duty with Company G, Second Battalion of Engineers, at Parang, Mindanao, P. I., engaged in the construction of the Parang-Cottabato road.

August 22 to September 3, 1902.—Constructing road from Malabang to Lake Lanao.

November 1-13, 1902.—Engaged on survey of military reservation at Malabang, Mindanao.

November 1-30, 1902.—Making map of Parang Bay and plan for wharf. Constructing wharf at Parang and a telegraph line from Parang to Cottabato.

April 5-19, 1903.—Engineer officer, Bacalod expedition, under the command of Capt. John J. Pershing, Fifteenth Cavalry, U. S. Army.

April 20 to May 25, 1903.—On duty at Parang, engaged on road construction from Parang to Cottabato and in building wharf at Parang.

May 26 to June 12, 1903.—On duty at Zamboanga, turning over property to Capt. Jay J. Morrow, Corps of Engineers.

June 12-15, 1903.—En route to Manila.

June 15, 1903.—Reported to the commanding officer, post of Manila.

June 17, 1903.—Reported to the commanding officer, Company I, Third Battalion of Engineers.

June 24, 1903.—Relieved from duty with Company I, Third Battalion of Engineers.

May 11 to June 30, 1903.—In charge of construction of wharf at Iligan and of bridge over Nonucan River.

June 2, 1903.—Assigned to Company I, Third Battalion of Engineers.

LIEUT. WARREN T. HANNUM.

November 1, 1902.—Arrived at Manila, P. I., on transport *Thomas* and assigned to Company H, Second Battalion of Engineers. Instructing the enlisted men of the engineer garrison, Manila, P. I., in infantry, cavalry, and practical military engineering drills.

December 9-23, 1902.—Engaged in making a survey of Malahi Island, Laguna de Bay, Luzon.

February 17-25, 1903.—En route to Cebu, Cebu, to make topographical surveys of sites for gun emplacements projected for fortifying the harbor of Cebu. Engaged on these surveys until April 10, 1903.

April 11-16, 1903.—En route to Manila, P. I.

April 17-30, 1903.—Preparing maps and report on surveys at Cebu.

May 17-21, 1903.—En route to Jolo, Jolo.

May 21 to June 30, 1903.—In charge of construction of a wharf at Jolo, Jolo. Disbursing officer of public civil funds for construction of wharf at Jolo and for construction of wharf at Siasi.

June 2, 1903.—Assigned to Company K, Third Battalion of Engineers.

RIVER AND HARBOR IMPROVEMENTS.

Appropriations.—The funds with which the works for the improvement of rivers and harbors were prosecuted during the past fiscal year were derived from the appropriations made by the river and harbor act approved June 13, 1902; the sundry civil act approved June 28, 1902; the sundry civil act approved March 3, 1903, and from such balances of former appropriations as were available.

The following works are provided for by permanent appropriations: Removing sunken vessels; operating and care of dredge boats on upper Mississippi River; removing obstructions in Mississippi River; gauging waters of lower Mississippi River and its tributaries; examinations and surveys at South Pass, Mississippi River; maintenance of South Pass channel, Mississippi River; operating snag boats on Ohio River; operating and care of canals, etc.; support and maintenance of the Permanent International Commission of the Congresses of Navigation.

Status of works.—Statements derived from the reports of the officers in charge of the various works, and given herewith, set forth the condition of each improvement and the extent of the work performed during the past fiscal year.

Expenditures.—The total amount actually expended under the direction of the Chief of Engineers in connection with the improvement of rivers and harbors during the fiscal year ending June 30, 1903, is as follows:

Rivers and harbors (general, including examinations, surveys, and contingencies)	\$15,036,481.53
Removing sunken vessels	51,312.70
Operating snag and dredge boats on upper Mississippi River	25,000.00
Removing obstructions in Mississippi River	72,587.48
Gauging waters of lower Mississippi River and its tributaries	8,378.64

Maintenance of South Pass channel, Mississippi River	\$108, 861. 20
Examinations and surveys at South Pass, Mississippi River	9, 115. 80
Operating snag boats on Ohio River	32, 655. 08
Operating and care of canals, etc	1, 091, 515. 05
Prevention of deposits in New York Harbor	78, 133. 02
California Débris Commission	9, 535. 49
Permanent International Commission of Congresses of Navigation ..	2, 032. 24
Total	16, 521, 429. 98

This amount does not include the following:

1. Expenditures under Mississippi River Commission	\$1, 684, 786. 94
2. Enlargement of Governors Island, New York Harbor	76, 654. 26
3. Payment to C. P. Goodyear on account of improvement of Brunswick outer bar, Georgia	45, 000. 00

Estimates.—The following estimates are submitted by the Chief of Engineers for the fiscal year ending June 30, 1905:

Under continuing contracts	\$11, 540, 753. 00
Rivers and harbors (general)	20, 748, 990. 00
Examinations, surveys, and contingencies	300, 000. 00
Under California Débris Commission	15, 000. 00
Prevention of deposits in New York Harbor	73, 260. 00
Enlargement of Governors Island, New York	200, 000. 00

The Mississippi River Commission submits an estimate amounting to \$2,545,000.

Engineer divisions.—The engineering works in the charge of this office are arranged in divisions, and officers of the Corps of Engineers were assigned as division engineers to overlook these works, as follows:

West of the Rocky Mountains: Pacific Division, Col. D. P. Heap; Northern Pacific Division, Lieut. Col. W. H. Heuer. East of the Rocky Mountains: Northeast Division, Col. Charles R. Suter; Eastern Division, Col. S. M. Mansfield (now brigadier-general, United States Army, retired) to February 25, 1903, and Col. Amos Stickney since that date; Southeast Division, Col. Peter C. Hains (now brigadier-general, United States Army) to March 31, 1903, and Lieut. Col. James B. Quinn since that date; Gulf Division, Lieut. Col. H. M. Adams; Western Division, to February 13, 1903, Col. Amos Stickney; Central Division, Col. G. J. Lydecker; Northwest Division, Col. O. H. Ernst.

Preliminary examinations and surveys.—Section 14 of the river and harbor act approved June 13, 1902, provides for preliminary examinations and surveys of certain localities, and the duty of making the same has been assigned to Boards of Engineers and officers of the Corps of Engineers in charge of the various engineering districts. It is expected that reports thereon will be received and reviewed by the Board of Engineer officers established by section 3 of the river and harbor act of June 13, 1902, in time for transmission to Congress at the opening of its session in December next. Reports on examinations and surveys required by section 1 of the act have, as far as received, been incorporated as appendixes to this report. The others will be submitted, if possible, in time for transmission to Congress at its next session.

Survey of United States land within the flats of Anacostia River, District of Columbia.—The District of Columbia appropriation act of July 1, 1902, appropriated \$5,000 to be expended under the direction of the Secretary of War for making a survey and outline map of land

owned by the United States within what is known as the flats of the Anacostia River from its mouth to the boundary line of the District of Columbia, and authorized and directed the Attorney-General to report upon the nature of title to lands embraced within said flats. The survey has been made, and report thereon by Lieut. Col. Chas. J. Allen, Corps of Engineers, dated February 17, 1903, with maps, has been transmitted to the Attorney-General with a view to examination and report pursuant to the law.

Survey for wagon road into Mount Rainier National Park, Washington.—The sundry civil act of March 3, 1903, authorized a survey for a wagon road into Mount Rainier National Park. By direction of the Secretary of War this duty was assigned to Maj. John Millis, Corps of Engineers, and the survey is now in progress.

Bridges over Ohio River impeding safe and convenient navigation.—The river and harbor act approved June 13, 1902, contains the following item:

The Secretary of War is authorized and directed to prepare a list of the bridges upon the Ohio River which are an impediment to safe and convenient navigation, and the nature and extent of the modifications required in each of them, and report the same to Congress, together with information as to whether necessary changes in said bridges, or any of them, can be secured under existing law, and if not, what legislation is necessary in order to secure proper changes or modifications in said bridges, respectively, and an estimate of the cost thereof on each bridge: *Provided*, That the Attorney-General is authorized and directed to furnish, upon the request of the Secretary of War, an opinion upon the question whether the owners of these bridges, or any of them, can be required, under existing laws, to make the necessary changes at their own expense, and, if further legislation is required, whether by such legislation the owners of such bridges, or any or either of them, can be required to make such changes and modifications at their own expense, or whether such changes or modifications, or any or either of them, must be borne by the United States, which opinion shall accompany the report of the Secretary of War to Congress.

The duty of preparing the required information was duly assigned to the local officer having charge of the general improvement of the river, and it is expected that report on the subject will be received in time for consideration by the Attorney-General and transmission to Congress at its next session.

ATLANTIC COAST AND GULF OF MEXICO.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE, EAST OF AND INCLUDING PORTLAND HARBOR.

This district was in the charge of Maj. S. W. Roessler, Corps of Engineers. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. *Lubec Channel, Maine.*—This channel lies between the eastern extremity of the State of Maine and Campobello Island, Canada.

Originally the channel was about 5 feet in depth at mean low tide and 2 feet at low water of spring tides, the mean range in tide being 18.2 feet. A project was adopted in 1879, which, as subsequently modified, provided for a channel 275 feet wide, increasing to 300 feet in the bends, and 12 feet deep at mean low tide. This project was completed in 1890 practically as proposed. The present project was adopted in 1894, and its object was to widen the existing channel to a least width of 500 feet, at an estimated cost of \$150,000.

The expenditures to June 30, 1903, amounted to \$168,954.68 on the old project and \$96,906.82 on the present project. At that date the channel had been widened to the projected width, except at the lower portion of the channel where a strip about 3,900 feet long and about 130 feet in average width remains to be excavated in order to complete the improvement.

A contract dated October 18, 1902, has been made, and work will be commenced this fall, and the project completed during the fiscal year, under the appropriation of \$53,000 contained in the river and harbor act of June 13, 1902.

This channel is an international one and the benefits from the improvements are almost entirely general. As the tidal currents are very strong and dense fogs prevail a large part of the time, the widening of the channel decreases the chances of stranding and collision.

The commerce is reported as follows:

	Tons.		Tons.
1896	52, 300	1900	76, 800
1897	53, 400	1901	165, 000
1898	87, 000	1902	148, 400
1899	126, 700		

July 1, 1902, balance unexpended	\$53, 516. 82
June 30, 1903, amount expended during fiscal year	378. 32

July 1, 1903, balance unexpended	53, 138. 50
--	-------------

July 1, 1903, amount covered by uncompleted contracts	49, 250. 00
---	-------------

(See Appendix A 1.)

2. *Narraguagus River, Maine.*—The navigable portion of the river is 7 miles in length. The town of Millbridge is located about 2 miles above its mouth and the lumber town of Cherryfield at the head of navigation. The mean range of tide is 11.3 feet.

Before improvement the river was obstructed from its mouth to Millbridge by a bar having a depth of 6 feet at mean low tide and less than 4 feet at extreme low tide. Between Millbridge and Cherryfield the river was obstructed by bowlders and ledge.

The original project upon which the first appropriation was made is set forth in the district officer's report of December 8, 1870, and provided only for the betterment of navigation above Millbridge by the removal of obstructions, such as mill waste, sunken bowlders, and the construction of an iron spindle on Half Tide Rock. This work was completed in 1874. The amount expended was \$22,000, and the resulting improvement is said to have been of great benefit to navigation.

The improvement of the river below Millbridge was provided for by project submitted in 1880. Its object was to dredge a channel 200 feet wide and 11 feet deep as far up as Long Wharf, and 9 feet thence to the anchorage known as Deep Hole. The estimated cost was \$50,000, and appropriations aggregating this amount were made between 1886 and 1899.

The amount expended on the latter project to the end of the fiscal year 1903 was \$49,643.81; but the project was not completed as originally projected, a change having been made necessary by the abandonment of Long Wharf by the steamboat company and the erection of a new wharf farther down the river. This change of location of

the steamboat wharf rendered unnecessary any further dredging above that point, and accordingly the last appropriation was expended in dredging in front of the wharf and between that point and the deep water of the bay. In obtaining a depth of 11 feet to the steamboat wharf where it is now located the main object of the improvement has been accomplished. The work is only temporary. The material excavated was a mixture of sawdust and mud and will be replaced in the course of a few years by a new deposit of the same material. It is reported that the portion of the river in front of the wharf has already shoaled to a depth of 7 feet at mean low tide.

Nothing has been done during the fiscal year.

The commerce for the last eight years is given as follows:

Tons.		Tons.	
1895.....	54,750	1899.....	23,545
1896.....	16,175	1900.....	35,825
1897.....	41,500	1901.....	41,934
1898.....	26,147	1902.....	32,885

July 1, 1902, balance unexpended	\$416. 19
June 30, 1903, amount expended during fiscal year.....	60. 00

July 1, 1903, balance unexpended	356. 19
--	---------

(See Appendix A 2.)

3. *Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Me.*—The object of the breakwater is to protect the wharves of Bar Harbor and the anchorage in front of the town from the heavy seas of southerly gales.

The present project is the original one approved June 14, 1889, modified as to length of breakwater by the revised project of 1893. It provides for a breakwater of riprap stone, extending from Porcupine Island a distance of 2,500 feet in a westerly direction to a point about 600 feet from the low-water line of Mount Desert Island, the estimated cost being \$420,200.

The expenditures to June 30, 1903, were \$189,789.18, by which date the breakwater had been raised to a height of mean high tide for a distance of 1,790 feet from Porcupine Island. The width on top is 20 feet and the side slopes are such as the rock naturally assumes. It is proposed to expend future appropriations in extending the breakwater to the same height and section until the projected length is reached. After that the question of strengthening the sea slope and raising the breakwater will be considered.

The beneficial effects resulting from the portion of the breakwater already built in protecting the wharves at Bar Harbor and the anchorage basin are appreciably felt; but in order to secure the desired protection at high water of spring tides it will probably be found necessary to raise the breakwater to a height of about 6 feet above mean high tide. The mean range in tides is 11.5 feet.

The benefits to navigation are general in providing a harbor of refuge, and local in making it possible for boats to land at the wharves at all times with safety. The only convenient method of transportation to and from Bar Harbor is by boat.

No operations beyond inspection have been carried on during the fiscal year.

The commerce has been reported as follows:

	Tons.
1898.....	22, 175
1899.....	24, 393
1901.....	42, 150
July 1, 1902, balance unexpended	\$210. 82
July 1, 1903, balance unexpended	210. 82

{ Amount (estimated) required for completion of existing project.....	230, 200. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	30, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 3.)

4. *Harbor at Sullivan Falls, Maine.*—Sullivan River has a length of about 6 miles and is the outlet of a large bay. About midway of its length a point of land projects to such extent as to reduce the width to about one-fourth that immediately above and below, and at this place the slope and velocity are such that the locality is termed Sullivan Falls. The bottom is ledge, the higher portions forming dangerous obstructions to navigation. Hatchers Rock, about midway of the narrow channel at the falls, had originally only about 6 inches of water over it at mean low tide. The mean range in tides is 11.5 feet.

Under a project set forth in report of the district engineer, dated December 10, 1870, and under appropriations based thereon, the sum of \$35,000 was expended in removing three old piers, in excavating the obstructing ledges at the falls to a depth of 7 feet at mean low tide, and in replacing spindles on two rocks near the mouth of the river. This work was completed in 1875 and was of material benefit to navigation.

The present project is that referred to in the river and harbor act of June 3, 1896, as the "approved project," and published in House Executive Document No. 84, Fifty-first Congress, second session, and in the Annual Report of the Chief of Engineers for 1891, page 619. It provides for removing Hatchers Rock and two other points of ledge to a depth of 10 feet at mean low tide, at an estimated cost of \$35,000.

The expenditures under the existing project to June 30, 1903, were \$9,628.24, and the operations consisted in removing the entire area of Hatchers Rock and about five-sixths of ledge "C" to a depth of 10 feet at mean low tide.

To complete the present project the remaining part of ledge "C," containing about 67 cubic yards in situ, and the ledge "B," containing 255.3 cubic yards in situ, will have to be removed.

The improvement not only increases the navigable depth, but also, by removing the cause of eddies and cross currents, has added to the length of time at each high and low tide during which vessels may pass through the rapids with safety.

Vessels can not use the channel at low stages except when the tide is slack. This occurs after the tide has flowed about 2 feet, at which time vessels drawing 11 feet can pass through safely.

The improvement may be regarded as permanent.

The commerce for the last six years has been as follows:

	Tons.		Tons.
1897.....	50, 790	1900.....	35, 926
1898.....	41, 700	1901.....	49, 125
1899.....	42, 125	1902.....	37, 050

July 1, 1902, balance unexpended.....	\$5,464.69
June 30, 1903, amount expended during fiscal year.....	92.93
July 1, 1903, balance unexpended.....	5,371.76
July 1, 1903, outstanding liabilities.....	5,000.00
July 1, 1903, balance available.....	371.76
{ Amount (estimated) required for completion of existing project.....	20,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 4.)

5. *Union River, Maine.*—The navigable portion of the river extends from the head of Union Bay to the foot of the falls at Ellsworth, a distance of about 3 $\frac{1}{4}$ miles.

Before improvement the channel was obstructed by a large deposit of slabs, edgings, and sawdust near Ellsworth, which practically suspended navigation, except at high tide, by projecting ledges in the narrows about three-fourths of a mile below the wharves at Ellsworth, by boulders at several points along the channel, and by a broad, flat bar of sawdust and mud at the mouth.

The first project for the improvement of the river is contained in the report of the district officer, dated June 30, 1867, and provided for erecting beacons, removing sunken ledges and boulders, and dredging mill waste near Ellsworth, so as to secure a depth of 3 feet at mean low tide, this being the available depth on the bar at the mouth of the river. This improvement was completed in 1873 with an expenditure of \$30,000.

A survey was made in 1889 under the provisions of the act of 1888, and a new project was submitted with a view to obtaining a depth of 6 feet at mean low tide from the wharves at Ellsworth to deep water in the bay. This depth was to be obtained by dredging mill waste near Ellsworth, by removal of ledge in the Narrows, and by dredging across the bar at the mouth of the river. To maintain the improved depth at the latter point the same project provided for the construction of a training wall to concentrate the ebb flow in the channel. The present authorized project is that described above with the training wall omitted, and is published on page 461, Part I, Annual Report of the Chief of Engineers for 1890.

The act of June 3, 1896, appropriated \$15,000 for beginning the improvement. This sum was expended in excavating to a depth of about 6 feet over a section of river about 3,000 feet long in the vicinity of the Narrows, and in carrying a single cut of the dredge to the same depth as far up as the wharves, to afford immediate relief to navigation. This single cut was partly filled with new deposit by the next freshet.

By the act of March 3, 1899, the sum of \$15,000 was appropriated and a contract was authorized for completing the improvement at an additional cost of \$115,000.

Changes having occurred since the making of the survey upon which the project was based, a new survey was made in May, 1899, and a project for securing the completion of the improvement, with such changes in quantities as were shown to be necessary by the survey, was approved by the Secretary of War June 28, 1899.

A contract for all the work necessitated by the project was entered into October 16, 1899. Operations were commenced May 26, 1900, and the contract was completed August 21, 1902. The total quantities of work accomplished were as follows:

	Cubic yards.
Dredging in vicinity of Ellsworth, sawmill waste and all material other than compact gravel or hardpan and bowlders.....	202,594
Hardpan and bowlders at same locality	7,581
Dredging at mouth of river.....	75,360
Excavating ledge in Narrows and removing large bowlders.....	7,563

The dredging at the mouth of the river and the removal of ledge in the Narrows were accomplished in accordance with the project. The channel in the vicinity of Ellsworth, where the material was sawmill waste, was dredged, but owing to movement of the mill-waste deposit during freshets the full depth has not been maintained.

The amount expended upon this project to June 30, 1903, was \$142,101.36.

The mean range in tide is 11.5 feet.

The commerce for the last six years is as follows:

	Tons.		Tons.
1897	57,685	1900	42,580
1898	50,462	1901	37,749
1899	49,800	1902	32,169
July 1, 1902, balance unexpended			\$38,558.31
June 30, 1903, amount expended during fiscal year			35,659.67
July 1, 1903, balance unexpended			2,898.64

(See Appendix A 5.)

6. *Bagaduce River, Maine.*—This is a small stream that empties into Penobscot Bay at Castine, Me. The upper part of the river divides into two branches, one called Northern Bay and the other South Bay. Northern Bay, near South Penobscot, is a shoal sheet of water of about 700 acres area, the bottom of which for the greater part is bare at low tide. Before improvement there was a narrow channel from Bridges Point to Bowden's wharf, which had a depth of less than 2 feet and was obstructed by ledges and bowlders near Winslows Island. The South Bay is obstructed by ledges at Johnsons Narrows. Mean rise and fall of tide, 9.8 feet.

The approved project is understood to be that published in House Ex. Doc. No. 157, Fiftieth Congress, first session, and at page 398 of the Annual Report of the Chief of Engineers for 1888. Its object is to secure a channel 100 feet wide and 6 feet deep at mean low tide from Bridges Point, Northern Bay, to Bowden's wharf, at an estimated cost of \$45,000. The same project provides for removing a small quantity of rock in the channel at Johnsons Narrows at an estimated cost of \$1,875. All work done has been in accordance with this project.

The expenditures to June 30, 1903, were \$24,697.19. At that date there had been obtained by dredging and by the removal of rocks and bowlders, mainly at Winslows Island, which was the shoalest place, a channel 40 feet wide and about 2 feet deep at mean low tide.

Navigation has not been appreciably benefited by the improvement. The improvement is of doubtful public benefit.

It is proposed to apply the appropriation of June 13, 1902, in continuing the removal of bowlders at Winslows Island and in dredging.

No operations were carried on during the past year.

The commerce for the last eight years is given, as follows:

	Tons.		Tons.
1895	85,900	1899	89,500
1896	78,050	1900	86,000
1897	86,600	1901	95,900
1898	79,965	1902	99,250

This includes the business done at Castine, at the mouth of the river.

July 1, 1902, balance unexpended	\$3,347.81
June 30, 1903, amount expended during fiscal year	45.00

July 1, 1903, balance unexpended	3,302.81
--	----------

{ Amount (estimated) required for completion of existing project	18,875.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	2,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 6.)

7. *Penobscot River, Maine.*—Except the dredging of a sawdust bar opposite High Head, near Bucksport, Me., the improvements have been confined to a stretch of about $3\frac{1}{2}$ miles of the river at and below Bangor. Before improvement this part of the river was obstructed by ledge, bowlders, and mill waste to such extent as to afford a safe available depth of only about 6 feet at extreme low tide. The mean range in tides is 13.1 feet.

The original project is given in the district officer's report of August, 1870, and was approved August 22, 1870. Its object was to obtain, by dredging and by removing obstructing ledges and bowlders over $3\frac{1}{2}$ miles of river at and below Bangor, an unobstructed channel having a width of 150 feet and a depth of 12 feet at the lowest tides. There was expended prior to the adoption of the present project \$198,300.

The present project is an extension and modification of that of 1870. It is based on a survey ordered by the act of September 19, 1890, and its object is to secure a channel depth of 11 feet at extreme low tide for a width of 360 feet in Bangor Harbor; to widen, straighten, and deepen the channel near Crosbys Narrows and Stern's mill to a depth of 12 feet at extreme low tide; and to secure a depth of 22 feet at mean low tide between Bucksport and Winterport, at an estimated cost of \$440,000.

In 1899 the project was extended to include certain work at Bangor Harbor, estimated to cost \$28,000.

The expenditures under the existing modified and enlarged project to June 30, 1902, amounted to \$169,327.13, and the object of the general project has been virtually accomplished.

The available depths are as follows: Bangor Harbor, 14 feet at mean low tide, or 11 feet at extreme low tide; at Stern's mill and Crosbys Narrows, 15 feet at mean low tide, or 12 feet at extreme low tide. The shoal at Frankfort flats was dredged to 22 feet at mean low water, and, so far as known, has given no trouble since. The shoal at High Head above Bucksport was dredged to the same depth, but afterwards shoaled up to a certain extent and subsequently deepened again by the natural scour of the river. Examination made since the dredging was done shows that the depths on the bar vary and that no material benefit has been obtained by dredging.

In view of the shifting character of this bar, the utter failure to obtain a permanent improvement by dredging, and the fact that it is not in any way a dangerous obstruction to navigation, no further work is recommended upon it at this time.

In the act of March 3, 1899, Congress adopted a project for further local improvement in Bangor Harbor, the object being to remove the ledge in front of the Boston and Bangor Steamboat Company's wharf to a depth of 11 feet at extreme low tide, and to deepen the basin of the Kenduskeag stream at its junction with the Penobscot River. As approved by the Secretary of War, May, 1899, the detailed plan of improvement of the Kenduskeag River, under the general project adopted by the act of March 3, 1899, contemplated dredging through both draws of the railroad bridge, and within the basin between the lower bridge and the post-office bridge, so as to obtain a uniform depth of about 2 feet below mean low water to within 30 feet of the wharf.

Both improvements were completed by the removal of 2,225 cubic yards of ledge in front of the Boston and Bangor Steamboat Company's wharf and 15 cubic yards of bowlders and 27,428 cubic yards of gravel and sand from the basin of the Kenduskeag stream. The improvement at the Boston and Bangor steamboat wharf is permanent; that in the mouth of the Kenduskeag not so. The depth it was expected to obtain in the latter was 2 feet below mean low water, but the available depth secured is, in fact, less than this on account of bowlders brought in by freshets and scattered over the basin.

When the ice began to move out in the latter part of March, 1902, an ice gorge was formed above the head of the Narrows, which, with an auxiliary gorge higher up in the vicinity of High Head at the lower part of the city, caused the water in Bangor Harbor to reach the highest level known since 1856, flooding the railroad station and tracks of the Maine Central Railroad, all the wharves, and all the business streets and basements adjacent to the basin of the Kenduskeag stream. From an observation made after the freshet by the engineer department of the Maine Central Railroad, it was estimated that the height of the flood was approximately 25 feet above mean low water or 12 feet above mean high tide. During the same freshet one span of the wagon bridge and the middle pier and two adjacent spans of the Maine Central Railroad bridge were carried away.

During the fiscal year no work has been done. It is proposed to apply a small sum to removing a number of large bowlders from the dredged area in the Kenduskeag Stream.

As above stated, the mean range in tide at Bangor Harbor is 13.1 feet, and the depth of water resulting from past improvements is 14 feet, giving a depth of $27\frac{1}{2}$ feet in the improved channel at high water of an average tide. The available high-water depth is some less than this at neap tide and correspondingly greater at spring tide. Deep-draft vessels always come in and depart at the height of the tide. Incoming vessels of deep draft are immediately docked on arrival, as there is not enough water in the channel to float them at low tide. There has been no special demand made for a further deepening of the channel of the river, but there has been a growing demand for more deep-water berths along the Bangor side of Bangor Harbor, where the deeper vessels can be docked without grounding at low water. At the present time the only wharf where vessels much exceeding 20 feet draft can be docked without grounding is at High Head, which is con-

trolled by the Maine Central Railroad Company. This is a very important coal-distributing point, and it is apparent that a further improvement of the harbor so as to develop more deep-water berths can no longer be deferred. It is recommended that a new survey and estimate for a further improvement of Bangor Harbor be authorized at the coming session of Congress.

The commerce of the river for the last eight years is given, as follows:

	Tons.		Tons.
1895	617, 859	1899	658, 632
1896	715, 911	1900	917, 835
1897	790, 698	1901	708, 012
1898	639, 671	1902	689, 369

July 1, 1902, balance unexpended	\$8, 672. 87
June 30, 1903, amount expended during fiscal year	42. 00

July 1, 1903, balance unexpended	8,630. 87
--	-----------

(See Appendix A 7.)

8. *Bucksport Harbor, Maine.*—The mean range in tide is 10.6 feet. Before improvement the bed of the river on the east side in front of the wharves of Bucksport was obstructed by a deposit of sawdust and mud, having a minimum depth of about 4 feet at mean low tide.

Under appropriations aggregating \$16,500, this obstructing shoal, locally known as the Middle Ground, was dredged between 1875 and 1878, under the general project for improving Penobscot River, to a depth of 12 feet at mean low tide over that portion of its area lying immediately in front of the wharves, and to a depth of 8 feet over the remainder.

The existing project is based upon a report of a survey printed in House Document No. 275, Fifty-sixth Congress, first session, and reprinted in the Annual Report of the Chief of Engineers for 1900, page 1103, and was adopted by the act of June 13, 1902. It provides for removing the Middle Ground, which has again shoaled, to a depth of 16 feet at mean low tide, at an estimated cost of \$20,000.

A contract dated October 14, 1902, for dredging the Middle Ground in front of the wharves of the town of Bucksport, Me., to a depth of 16 feet at mean low water, was made; the dredging was commenced April 3, 1903, and has been continued to the end of the fiscal year. The work is practically completed, only a few days' additional work being required to finish the project. At the end of the fiscal year 124,970 cubic yards, scow measurement, was removed.

As there are large sawdust and mud bars above this point which are set in motion in times of freshet, it is expected that the area dredged at Bucksport will slowly fill in again in the course of years. The improvement should therefore not be regarded as entirely permanent.

July 1, 1902, balance unexpended	\$20, 000. 00
June 30, 1903, amount expended during fiscal year	9, 474. 42

July 1, 1903, balance unexpended	10, 525. 58
July 1, 1903, outstanding liabilities	1, 060. 64

July 1, 1903, balance available	9, 464. 94
---------------------------------------	------------

July 1, 1903, amount covered by uncompleted contracts	9, 313. 69
---	------------

(See Appendix A 8.)

9. *Cumden Harbor Maine.*—The mean range in tide is 9.7 feet. Before improvement navigation was impeded by shoal water, there being a depth of about 6 feet in the outer harbor at the steamboat landing and less than 1 foot in the inner harbor, where most of the wharves are located.

The first project is contained in the district officer's report of December 17, 1872, and provided for dredging two channels, one 1,500 feet long, 100 feet wide, and 7 feet deep at mean low water on the easterly side of the harbor, the other 1,400 feet long, 100 feet wide, and 7 feet deep at mean low water. This improvement was completed in 1875, under appropriations aggregating \$30,000 made by acts of 1873, 1874, and 1875.

The harbor was again surveyed and a new project submitted in 1887, under the provisions of the river and harbor act of 1886. This project provided for dredging at the entrance to the harbor to a depth of 12 feet at mean low tide; to dredging a channel on each side of the harbor and approaches to the same to a depth of 10 feet; to dredging small channels along the wharves at the extreme upper end of the harbor to 5 feet, and after completion of the above, to dredging the Middle Ground of the harbor to the same depths as the adjacent channels. The project was completed in 1897 with an expenditure of \$44,940.79.

The total expenditures to June 30, 1902, were \$74,940.79.

There is one small stream emptying into the harbor at the extreme upper end, but it is not a silt-bearing stream, and it is believed that the improved depths have remained practically permanent.

Under the provisions of the river and harbor act of March 3, 1899, a new survey was made in the vicinity of the Boston and Bangor Steamboat Company's wharf in the outer harbor and a project submitted for increasing the depths in this vicinity to 14 feet at mean and 11 feet at extreme low water so as to accommodate the boats of this line, which have had difficulty in reaching their wharves at extreme low run of tides. The cost was estimated at \$7,400. This project is published as House Document No. 263, Fifty-sixth Congress, first session, and reprinted at page 1111 of the Annual Report of the Chief of Engineers for 1900. The appropriation of \$7,400 contained in the river and harbor act approved June 13, 1902, will be expended in completing this improvement.

A contract has been entered into for dredging the area in the vicinity of the Boston and Bangor Steamboat Company's wharf in the outer harbor. The contract is dated May 4, 1903, and embraces the removal of 26,600 cubic yards measured in situ at the price of 26½ cents per cubic yard, completing the project. The work was commenced on June 25, 1903, and 5,781 cubic yards, scow measurement, had been removed at the end of the fiscal year.

July 1, 1902, balance unexpended	\$7,459.21
June 30, 1903, amount expended during fiscal year.....	44.70
July 1, 1903, balance unexpended	7,414.51
July 1, 1903, outstanding liabilities	65.00
July 1, 1903, balance available	7,349.51
July 1, 1903, amount covered by uncompleted contracts.....	6,982.50

(See Appendix A 9.)

10. *Rockland Harbor, Maine.*—The wharves are located on the shores of three coves formed by two projecting points of land on the western side of the harbor, known as Crocketts Point and Atlantic Point. The general direction of the wharf frontage is north and south and the length of frontage is about 800 feet. Before improvement depths in front of the wharves increased very slowly. All the wharves except those at the end of Crocketts Point and Atlantic Point extended only a short distance beyond the low-water contour, a high mean range in tide, which at this point is 9.6 feet, being relied upon to give access to moderate and light draft vessels at high tides. The entrance to the harbor from the east has a width of about 9,000 feet.

Before improvement the anchorage in front of the wharves, vessels lying at the wharves, and the wharves themselves were endangered by heavy seas during easterly gales.

The first improvement undertaken was to render it a safe harbor of refuge for coastwise shipping and incidentally also to protect the wharves as far as possible from heavy seas. To accomplish this a project was adopted in 1881 in which two breakwaters were contemplated, one extending south from Jamesons Point, the other a detached breakwater nearer to and opposite the principal wharves in the town, both to be raised in the first instance to the level of mean tide, but with the expectation that a further raising would be necessary as experience might dictate.

In 1886 this project was amended so as to raise the height of the breakwater at Jamesons Point to the level of mean high tide. In 1890 it was again amended so as to eliminate the detached breakwater and to provide for extending farther south than was first contemplated the breakwater at Jamesons Point.

By the act of June 3, 1896, Congress adopted a project for dredging the inner harbor in the vicinity of the wharves to depths ranging from 4 feet to 13 feet at mean low tide and for removing two dangerous ledges, one occupying a central position in the harbor, which was to be cut down to the depth of 22 feet at mean low tide; the other, less centrally located, was to be removed to a depth of 14 feet. The estimated cost was \$403,000. By the same act this project was combined with that for the breakwater as one project, and authority was given for completing the whole under the continuous-contract system, at an estimated expenditure of \$1,036,000.

The dredging was finished in May, 1901; the removal of ledge in the fall of 1901. The breakwater was also completed to the height and slopes contemplated before the close of the same season. The work for the past fiscal year under these contracts consisted in the removal of 3,620 cubic yards of ledge and in the placing of 11,757 tons of stone on the breakwater. The total quantities in the above project were: Material dredged from harbor, 487,567 cubic yards; ledge removed, 30,180 cubic yards; stone placed in breakwater, 37,888 tons.

The displacement of a number of the heavy stones between high and low water on the exposed side of the breakwater during the gales of the winter of 1900–1901 indicated the necessity of further strengthening of the sea slope of the breakwater by the addition of more heavy stones. A project for this additional work was approved and a contract entered into for doing the work. This contract was completed June 30, 1902. The amount of stone placed under this contract was 32,656 tons, making a total of 768,774 tons in the breakwater.

An inspection of the breakwater was made July 21, 1903, by the district engineer. The top course of capstones was undisturbed the whole length of the breakwater. The sea slope between high and low water is protected by large stones, 4 to 8 tons in weight. A number of these were displaced during the storms of the past winter, and should be replaced. It is estimated that about 1,000 tons of rock, more or less, would be required to repair the damage to the slope. Funds in hand are sufficient for this repair work.

The total expenditures on the improvements in the harbor to June 30, 1903, were \$890,919.21.

The benefits resulting from these improvements are considerable. The breakwater has afforded a safe and extensive anchorage and harbor of refuge. The excavation of ledges has increased the available anchorage, and the dredging will afford access to the wharves by vessels of greater draft when the wharves are built out to the harbor line.

In dredging in the upper portion of the harbor, near Crocketts Point, several ledges were uncovered. The question is now being considered whether the needs of navigation will not be sufficiently improved by marking them by one of the usual aids to navigation, or whether their removal will be necessary. Should the latter course be decided upon, the balance of funds available under previous appropriations will be sufficient to do the work.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1895	615, 830	1899	755, 649
1896	580, 295	1900	553, 000
1897	594, 992	1901	522, 175
1898	579, 300	1902	470, 825
July 1, 1902, balance unexpended			\$45, 406. 59
June 30, 1903, amount expended during fiscal year			10, 825. 80
July 1, 1903, balance unexpended			34, 580. 79

(See Appendix A 10.)

11. *Carvers Harbor, Vinalhaven, Me.*—The object of the improvement is to secure a better anchorage than the harbor afforded in its natural state. Before improvement the anchorage area was limited as to area and depth, there being less than 8 feet at mean low tide over the most of it.

The project of improvement, as approved by the Secretary of War May 11, 1897, provides for dredging the inner harbor to a depth of 16 feet at mean low tide over an area about 23 acres in extent and at an estimated cost of \$64,000.

The expenditures to June 30, 1903, were \$24,978.44. With this sum about 14 acres of the proposed area of 23 acres to be dredged had been completed and about 50 per cent of the total estimated amount of material had been removed.

No operations beyond inspection have been carried on during the fiscal year. It is proposed to expend the appropriation of \$20,000 contained in the act of June 13, 1902, in continuing the dredging as far up the harbor as the funds will allow.

The improvement will be fairly permanent and will be a benefit to navigation in affording a harbor of refuge and increased facilities for reaching the wharf.

The mean range in tides is 9.3 feet.

The commerce for the last six years is given as follows:

	Tons.		Tons.
1897	63, 074	1900	64, 500
1898	60, 000	1901	78, 300
1899	63, 390	1902	77, 200
July 1, 1902, balance unexpended			\$20, 788. 31
June 30, 1903, amount unexpended during fiscal year			766. 75
July 1, 1903, balance unexpended			20, 021. 56
July 1, 1903, amount covered by uncompleted contracts			19, 295. 50
Amount (estimated) required for completion of existing project			19, 000. 00

(See Appendix A 11.)

12. Georges River, Maine.—This river is a tidal estuary with a mean rise and fall of the tide of 10 feet. The head of navigation is Thomaston, Me.

The navigable depth is full $3\frac{1}{2}$ fathoms to a point about 1 mile from Thomaston, but from this point to the head of navigation the channel before improvement was narrow, with a short bend at one point and with a least depth of about 11 feet at mean low tide.

By act of June 3, 1896, Congress adopted a project for dredging to 16 feet at mean low tide, and to widths as follows: As far up as the bend, 160 feet; in the bend, 220 feet; beyond the bend, 125 feet, narrowing to 90 feet at the upper end.

Under a contract made October 17, 1902, the remaining upper end of the proposed channel, 900 feet long and 90 feet wide, was dredged to a depth of 16 feet at mean low water. The work was commenced April 23, 1903, and completed May 27, 1903, and 16,808 cubic yards, scow measurement, was removed. In the bend of the channel near the beacon, where the channel formerly dredged had filled up considerably, 4,016 cubic yards was redredged, and a depth of 16 feet at mean low water was again obtained. The total quantity dredged under this contract in completion of the project was 20,824 cubic yards, measured in scows.

The expenditures to June 30, 1903, were \$20,642.23.

Gradual shoaling of the proposed channel by material brought down by freshets may be expected, but the process will be slow and a depth sufficient to accommodate the traffic will probably be maintained for a number of years.

The depth of the dredged channel is such that the vessels using it could be towed out at any stage of the tide, but, as the business does not seem to warrant the maintenance of a tugboat, they have to wait until near high water and a favorable wind in order to go out or in under sail with safety.

The commerce for the last six years is given as follows:

	Tons.		Tons.
1897	64, 250	1900	29, 225
1898	59, 000	1901	60, 000
1899	60, 000	1902	45, 000
July 1, 1902, balance unexpended			\$6, 212. 06
June 30, 1903, amount expended during fiscal year			854. 29
July 1, 1903, balance unexpended			5, 357. 77
July 1, 1903, outstanding liabilities			4, 214. 80
July 1, 1903, balance available			1, 142. 97

(See Appendix A 12.)

13. *Kennebec River, Maine.*—Before improvement the main channel of the river between the foot of Swan Island and Gardiner was obstructed by shoals near Beef Rock, with only 10 feet of water at mean low tide, by dangerous sunken ledges in Lovejoy Narrows, by a shoal below South Gardiner with only 8 feet on it at mean low tide, and by a ledge at Nehumkeg Island. The steamboat channel to the west of Swan Island (at Hatchs Rock) was obstructed by a shoal over which there was only $7\frac{1}{2}$ feet of water, and the channel between Gardiner and Augusta, a distance of $6\frac{1}{2}$ miles, was obstructed by shoals which gave a navigable depth of only $3\frac{1}{2}$ feet in low summer tides.

Appropriations for minor improvements were made at various times between 1827 and 1852.

In 1866 a project was begun for improving the upper part of the river with a view to obtaining a channel 7 feet deep and 100 feet wide at low water. This project, with modifications, was completed in 1877 and resulted in obtaining a channel 10 feet deep at mean low tide and not less than 100 feet wide in its lowest summer stages as far up as Gardiner, and a depth of $6\frac{1}{2}$ feet at low tide and width of 100 feet from Gardiner to Augusta.

The channel west of Swan Island, being obstructed by shoal water ($8\frac{1}{2}$ feet at mean low tide) and a too narrow channel at the head of the island, by shoal water at Hatchs Rock, below Richmond, and by a very narrow channel 30 feet wide at the foot of the island, was improved by dredging in 1881–1883, so as to give a channel 175 feet wide and 11 feet deep at the foot of the island and a channel of about 80 feet width and 10 feet depth at Hatchs Rock and the head of the island.

The river and harbor act of 1886 provided for a new survey of the river from Bath to Augusta. This survey was made in 1887, and a project embracing dredging, rock excavation, and contraction works was submitted for the further improvement of the river. In 1892 this project was revised to secure depths as follows: Thirteen feet at mean low tide as far up as Sands Island; 12 feet thence to Hinckleys Shoal, above Gardiner, and 10 feet thence to Augusta, at an estimated cost of \$388,500. This project was approved August 19, 1892, and was completed in 1898.

The total expenditures upon the river to June 30, 1903, upon the projects above enumerated were \$481,624.04.

The improved channel obtained under the above projects has suffered some loss of available depth by the deposits brought down by freshets. This shoaling has been most marked in the stretch of $6\frac{1}{2}$ miles of river between Gardiner and Augusta, the further improvement of which is provided for by the river and harbor act approved June 13, 1902, which appropriated \$40,000 and authorized a continuous contract for the completion of the project. The last project is published in House Document No. 262, Fifty-sixth Congress, first session, and at page 1121 of the Annual Report of the Chief of Engineers for 1900, and proposes a widening of the channel from Gardiner to Augusta to 125 feet, and a cleaning out of the old dredged channel and its further deepening to 16 feet at mean high water, or 11 feet at mean low water.

The spring freshet of 1902 was of more than average height and duration, and caused injurious shoaling in the main channel on the east of Swan Island, at Beef Rock shoal, and in the west channel at the head of the island, at Hatchs Rock, but more particularly abreast of Theobalds Point, near the foot of the island. The shoaling at Beef Rock was 3 feet, giving 11 feet at mean low tide, where a depth of 14

feet had been maintained since the dredging of 1892, and that at Theobalds Point, where the depths had heretofore always been ample, had reduced the available depth of water to about 8 feet at mean low tide. A deepening of the channel at both points being very urgent, a dredge was hired to dredge these shoals at a cost of about \$5,000.

The dredging was commenced June 17, 1902, and completed August 5, 1902, making 11 feet at mean low tide at Theobalds Point shoal, and 14 feet at mean low tide at Beef Rock shoal.

The estimated quantities of shoaling which has taken place over the shoal at "head of Swan Island," the shoal "at Hatchs Rock jetties," and below Hatchs Rock jetties are, respectively, 2,539, 6,017, and 4,550 cubic yards in situ, or a total of 13,106 cubic yards, situ measurement.

No contract has been made nor have any operations other than above been carried on during the fiscal year.

The mean rise and fall of tides at Bath is 6.9 feet; Gardiner, 5.1 feet; Augusta, 4.3 feet.

The commerce for eight years is given as follows:

	Tons.		Tons.
1894	1,207,965	1899	714,189
1895	1,162,972	1900	716,930
1897	665,991	1901	542,626
1898	1,211,808	1902	431,118

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$27,076.53
June 30, 1903, amount expended during fiscal year	8,350.57
July 1, 1903, balance unexpended	18,725.96

BETWEEN GARDINER AND AUGUSTA.

July 1, 1902, balance unexpended	\$40,000.00
July 1, 1903, balance unexpended	40,000.00

{ Amount (estimated) required for completion of existing project	41,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	41,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix A 13.)

14. *Portland Harbor, Maine.*—The entrance to the main part of the harbor of Portland, or the anchorage, has always been good, but before improvement the approach to the inner harbor was obstructed by a shoal known as the Middle Ground, over which the depth was only from 8 to 10 feet at mean low tide, while between it and Stamford ledge the greatest available depth was only 16 feet. The best part of the wharf front was exposed to swell from the main entrance, which sometimes made it dangerous for vessels to lie at the docks, and along this front the depth was in some places as shallow as 4 feet.

The first work of improvement undertaken by the Government was the construction of the breakwater. This was begun as early as 1836. It was completed in 1874.

The work of deepening the harbor was begun under the act of Congress of 1868, the plan of improvement being to excavate a channel 300 feet wide and 20 feet deep at mean low tide through the southern slope of the Middle Ground and to remove the bar off the Grand Trunk Railroad wharves to the same depth.

The project was modified in 1870 so as to provide for a channel 400 feet wide, and again in 1871 so as to provide for a channel 500 feet wide. In 1872 further modifications were made by including in the project the dredging of Back Cove and the dredging of the inner harbor up to the harbor commissioner's lines to a depth of 16 feet at mean low tide. The project, modified as above described, excepting some dredging in the inner harbor, was completed by 1876. Between 1881 and 1885 the Middle Ground was removed to a depth of 21 feet at mean low tide.

A further deepening of a portion of the harbor to 29 feet at mean low tide was next begun under the project of 1886. To this was subsequently added, in 1890, a small amount of dredging in the upper part of the harbor.

In 1894 the project was extended to cover the widening of the upper part of the 29-foot area and the dredging of a channel 25 feet deep to connect the deep water in the lower part of the harbor with deep water in the upper part. This work was completed in 1894.

By the act of June 3, 1896, Congress adopted a project for dredging to 30 feet at mean low tide over the greater part of the harbor, at an estimated cost of \$770,000, and included in the project the further improvement of Back Cove at a combined estimate of \$946,250. The same act appropriated \$20,000 for beginning work and authorized the making of a contract for its completion.

After twice advertising, a contract for the entire work was entered into. Dredging was begun July 2, 1897, and by the terms of contract was to be completed November 20, 1898. Progress from the first was slow and plant inadequate, and the contract was extended, under promise of better progress, to November 30, 1899. The contractors failed financially April 19, 1899, lost their dredge by seizure for debt, and never afterwards resumed work. After their retirement other arrangements were made, by the open-market method, to continue the dredging during the unexpired portion of said contract. This period having expired, the unfinished work was advertised. Bids therefor were opened March 27, 1900, and all rejected as too high. The work was again advertised, bids opened June 30, 1900, and a new contract entered into.

The work of the past fiscal year under the last-mentioned contract consisted in the removal of 257,365 cubic yards of material, situ measurement, being the equivalent of 287,692 cubic yards scow measurement. The total quantity dredged under contract with Morris & Cumings Dredging Company in completion of the contract is 2,434,470 cubic yards situ measurement, being the equivalent of 2,894,748 cubic yards scow measurement. The excess of scow over situ measurement is 460,278 cubic yards, or 18.9 per cent.

The quantities dredged under the several contracts are as follows:

	Cubic yards, situ.	Cubic yards, scow.
By George M. Valentine & Co.:		
Back Cove	152,347	201,556
Front harbor	1,317,366	1,660,441
Moore & Wright	343,696	429,361
Morris & Cumings Dredging Co.	2,434,470	2,894,748
Total quantity dredged under and in completion of the project	4,247,879	5,186,106

Excess of scow over situ measurement, 938,229 cubic yards, or 22.08 per centum.

There are no silt streams emptying into Portland Harbor, and the improved depths obtained under the project will be practically permanent. The maximum draft that can be carried to the wharves in Portland Harbor at mean low tide is 30 feet, and to the wharves in Back Cove about 11 feet. The mean range in tide is 8.8 feet.

Two principal advantages have followed this large improvement. A large and well-sheltered deep-water anchorage has been created under the shelter of the breakwater, and the trans-Atlantic vessels can arrive and depart from their docks at the lowest stages of tide.

The portion of the harbor in which most of the dredging has been done is the lower part of so-called Fore River. This river is crossed by four bridges. Going up the harbor these are: (1) Portland Bridge; (2) bridge of the Boston and Maine Railroad, eastern division; (3) Vaughan Bridge, belonging to city; (4) bridge of Boston and Maine Railroad, western division. Portland Bridge has a draw 65 feet wide and admits vessels of the largest class coming to Portland. The next two draws are deficient in width, but are to be widened to 60 feet before September 1, 1904, under order from the Secretary of War. When so rebuilt, a large part of the coal traffic which is now handled just above Portland Bridge, in a cramped berth, will seek a better discharging point above the second bridge. Above the latter bridge are also the works of the Standard Oil Company, and above the third bridge is a coal-discharging pocket. To meet the certain demand for deeper water above bridges when the draws are rebuilt, some dredging will be necessary, and it is recommended that the necessary survey and estimate be authorized at the coming session of Congress. At the single pocket just above Portland Bridge, which will be vacated for the better accommodation above the second bridge, 150 vessels were docked and 347,501 tons coal discharged for the year ending June 30, 1903.

A similar demand for increased depths up the entrance to Back Cove has resulted from the construction of large coal pockets along the Grand Trunk Railroad trestle, where it crosses Back Cove. To accommodate the class of vessels seeking these pockets a greater depth of water than now exists is necessary. It is recommended that a survey and estimate for improvement of this portion of the harbor be authorized. From January 1, 1903, to June 20, 1903, the large total of 196,792 tons of coal has been discharged at this point.

The total amount expended upon the harbor, including Back Cove, to June 30, 1903, is \$1,269,947.25.

The commerce for the last eight years is given as follows:

	Tons.		Tons.
1895	1,339,064	1899	1,620,284
1896	1,357,575	1900	2,261,008
1897	1,326,844	1901	2,461,515
1898	1,334,752	1902	2,224,091
July 1, 1902, balance unexpended			\$97,556.08
June 30 1903, amount expended during fiscal year			83,776.28
July 1, 1903, balance unexpended			13,779.80

(See Appendix A 14.)

15. *Removing sunken vessels or craft obstructing or endangering navigation.*—The wreck of a fishing schooner, *Harriet W. Babson*, damaged the bridge leading to the light-house on Ram Island, near the entrance to Boothbay Harbor, Maine, and was in danger of going into

the channel. Arrangements were made for its removal, but before the plant arrived the vessel had been broken up and removed by local wreckers. The total expense was \$143.27.

(See Appendix A 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE SOUTH OF PORTLAND HARBOR, IN VERMONT AND NEW HAMPSHIRE, IN MASSACHUSETTS NORTH OF LYNN HARBOR, AND IN NEW YORK ON LAKE CHAMPLAIN.

This district was in the charge of Capt. Harry Taylor, Corps of Engineers. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. *Saco River, Maine.*—The first work done on the Saco River was in 1827, when an appropriation was made for the erection of piers, placing beacons or buoys, and removing obstructions. Prior to this the depth of water on the bar was only about 2 feet at mean low tide, while much of the river was deeper. The entrance was also dangerous in rough weather, and the numerous projecting rocks and ledges in the river proper, in connection with the swift currents, made its navigation dangerous.

In 1866 a plan was proposed for the improvement of the mouth of the river, and a project was adopted in 1867. The project was for the construction of a breakwater, the removal of sunken rocks, and the rebuilding of some of the most important piers, against which vessels might drift without damage. This project was completed in 1878, at a cost of \$169,275.

A resurvey of the breakwater was made in 1883, and a new plan submitted for raising and repairing it and extending it out to Sharps Ledge.

The river and harbor act of 1884 directed a survey to be made of the river. This was done in 1885, and a plan submitted for the improvement of the river proper from its mouth to the head of navigation. In 1890 the two projects were combined, so that the one now in process of execution is for improving Saco River, including the breakwater and jetty, the estimated cost of completion of both river improvement and breakwater being placed at that time at \$185,000.

The amount expended on the work of existing project up to June 30, 1903, is \$172,258.37.

The work done under both the old and new projects has resulted in removing dangerous ledges, in constructing piers to prevent vessels from being swept on the rocks, in constructing a breakwater on the north side of the entrance, and a jetty on the south side of the entrance to contract the channel way with a view to obtaining a greater depth over the bar; also in deepening the channels in the upper portion of the river by dredging, and the construction of contraction works.

An examination made in 1900 showed that about 3½ feet at mean low water is the maximum draft that can be carried over the bar just outside the breakwater and jetty. The head of navigation on this river is Biddeford, Me. The mean rise and fall of tide is 8.8 feet.

In order to maintain the desired depth the breakwater on the north side should be extended to Sharps Ledge, as contemplated by the plan of improvement submitted in 1883, so as to stop the influx of sand from that side. Some uncertainty exists whether Congress has adopted

the plan of extending the breakwater to Sharps Ledge. The probable cost of such extension and some minor repairs is estimated by the officer in local charge to be \$200,000. Possibly the full extension may not be required to secure and maintain the projected depth.

No operations have been in progress during the past fiscal year, and on June 30, 1903, the condition of the improvement was the same as on the date of the last annual report.

The commerce of the last ten years is given as follows:

	Tons.		Tons.
1893	59, 765	1898	44, 508
1894	47, 350	1899	46, 597
1895	62, 129	1900	50, 354
1896	46, 956	1901	42, 625
1897	42, 214	1902	38, 072
July 1, 1902, balance unexpended			\$5, 241. 63
July 1, 1903, balance unexpended			5, 241. 63

{ Amount (estimated) required for completion of existing project.....	200, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	40, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 1.)

2. *Kennebunk River, Maine.*—The latest project for improvement of this stream was completed during the fiscal year 1893, and up to that time the sum of \$83,667.50 had been expended in the repair and extension of the piers and wharf at the mouth of the river.

Deterioration of the works of improvement has occurred to such extent as to require restoration at an early date and an estimate of \$3,500 is submitted for the purpose.

The commerce of the place is considered sufficient to justify the maintenance of the works.

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement.....	\$3, 500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

3. *Harbor at Isles of Shoals, Maine.*—A description of this harbor may be found in the Annual Report of the Chief of Engineers for 1900, Part II, page 1172, and is also published, together with a map of the harbor, as House Doc. No. 255, Fifty-sixth Congress, first session.

The principal island of the group known as "Isles of Shoals" is Star Island, on which is located the old village of Gosport. Gosport Harbor lies to the north of this island and is protected on its north and east by Smuttynose Island, and on the south and southeast by Star and Cedar islands, and on the east by what remains of a breakwater constructed by the United States in 1821–1823 between Smuttynose and Cedar islands, at a cost of \$13,251.61. This breakwater has been beaten down and spread out by the sea, so that its crest now averages only about 1½ feet above mean low water and is of little or no protection to the harbor.

The river and harbor act of June 13, 1902, appropriated \$30,000 for the completion of the improvement of this harbor in accordance with the report submitted in House Doc. No. 255, Fifty-sixth Congress, first session. The proposed improvement consists in the construction

of a breakwater on the site of the old one to a height of about 15 feet above mean low water, at a cost of \$30,000.

The total expenditures under the existing project to June 30, 1903, amount to \$41.55.

Work on the construction of the breakwater was begun in June, 1903.

The place is of considerable importance as a harbor of refuge for the numerous fishing boats and small vessels along the coast. The statistics of the amount of shipping directly interested can not be obtained, but would comprise all the great fleet of small vessels passing up and down the New England coast.

July 1, 1902, balance unexpended.....	\$30,000.00
June 30, 1903, amount expended during fiscal year.....	41.55
July 1, 1903, balance unexpended.....	29,958.45
July 1, 1903, outstanding liabilities.....	1,221.56
July 1, 1903, balance available.....	28,736.89
July 1, 1903, amount covered by uncompleted contracts.....	25,578.43

(See Appendix B 2.)

4. *Cocheco River, New Hampshire.*—Before the improvement was begun the river from Dover to the Lower Narrows was much obstructed by bowlders, ledges, and shoals, the depth being in some places as little as 6 inches at mean low tide. The tide rises and falls about 7 feet.

A project for improvement was adopted in 1871 and provided for a channel 40 feet wide and 4 feet deep from the Lower Narrows up to Collin's wharf. The estimated cost was \$45,000. Subsequently, more accurate and extended surveys having shown the practicability and importance of extending the improvements up to the head of navigation, the project was extended and the estimate increased to \$85,000. This project was completed in 1879. The improvements had opened up a large commerce, employing large vessels where formerly only flatboats had been used, in consequence of which the project was still further extended by providing for a "cut-off" through Alleys Point, widening to 60 feet and deepening to 5 feet the existing channels through Trickeys and Clements Point shoals, and blasting and removing other obstructions. The extended project was completed in 1888. The total amount expended on the original and modified projects to that time was \$170,000. These expenditures resulted in giving a channel through the rocky bed of the river 5 feet deep and 40 feet wide in the narrowest parts, where the depth before was only from 6 inches to 2 feet.

In 1889 a new survey was made under the river and harbor act of 1888, and a new project was submitted for obtaining a depth of 7 feet, increased to 7½ feet in rock, with a width of 50 feet in rock and 60 to 75 feet where the material is less expensive to remove. This project was adopted in 1890, and is estimated to cost \$175,000.

The total expenditures under the project of 1890 up to June 30, 1903, amount to \$88,318.21, not including \$7,538.41 expended on Lamprey River under authority of the act of June 13, 1902, which authorized the expenditure of not to exceed \$10,000 on Lamprey River from the appropriation of \$30,000 made for Cocheco River by that act.

Under this project the upper end of the channel at Dover has been deepened to 7 feet at mean low tide for a length of 1,200 feet down river, with a width varying from 100 to 140 feet. From this point the channel is now 50 to 75 feet wide, 7 feet deep at mean low water (and 7½ feet in rock) for a further distance of 5,770 feet, making a total length of channel at the upper end of 6,970 feet completed to full proposed dimensions, except over a small portion about 3,500 feet below Dover, where, owing to ledge, the required depth was not made.

The available depth is but 5 feet at mean low tide. The head of navigation on this river is Dover, N. H.

The river and harbor act of June 13, 1902, appropriated for continuing this improvement \$30,000, of which \$10,000 was authorized for expenditure on Lamprey River. At the time the authority was granted by Congress for the use on Lamprey River of a portion of the funds appropriated for the improvement of Cocheco River, the channel in Lamprey River, which had been dredged to a depth of 11 feet at high water about twenty years earlier, had nearly filled up. During the past fiscal year the channel has been restored to the depth and width originally provided up to the head of navigation at Newmarket, N. H., which completes the project.

The commerce for the last ten years is given as follows:

	Tons.		Tons.
1893	66,933	1898	131,005
1894	68,415	1899	144,040
1895	83,151	1900	155,180
1896	59,755	1901	199,890
1897	(^a)	1902	121,000
July 1, 1902, balance unexpended			\$36,075. 21
June 30, 1903, amount expended during fiscal year			11,931. 83
July 1, 1903, balance unexpended			24,143. 38
July 1, 1903, outstanding liabilities			6,901. 77
July 1, 1903, balance available			17,241. 61
July 1, 1903, amount covered by uncompleted contracts			15,400. 42
{ Amount (estimated) required for completion of existing project			62,538. 41
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.			25,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.			

(See Appendix B 3.)

5. *Exeter River, New Hampshire.*—A survey of this river was made in 1874 from its mouth in Great Bay up to the wharves at Exeter, a distance of 8.3 miles, and a project was submitted to obtain a towing channel with a minimum width of 40 feet and a minimum depth from the mouth to Oxbow (5.6 miles) of 12 feet at high tide and from Oxbow up to Exeter of 10 feet, and to remove the bowlders all the way up between the 10-foot contours down to a depth of 10 feet below high tide, at an estimated cost of \$34,000. This improvement was completed in 1882 at a cost of \$35,000.

Under the requirements of the river and harbor act of June 3, 1896, a new survey was made from the mouth of the river to the upper

^a No statement could be obtained.

bridge at Exeter and a report (printed in the Annual Report of the Chief of Engineers for 1897, p. 818) submitted, containing a project for a towing channel 40 feet wide, 12 feet deep at mean high tide up to Oxbow, and 11 feet deep at mean high tide thence up to Exeter, the estimate of cost being \$12,000. By the act of March 3, 1899, this project was adopted and the entire amount of the estimate appropriated.

Soon after operations had commenced under this appropriation it was found that considerable filling in had taken place since the last survey in 1896 and that the amount of the original estimate of \$12,000 would be insufficient to complete the work. An additional estimate of \$7,000 for the completion of the work is published on page 1040 of the Annual Report of the Chief of Engineers for 1901, and this amount was appropriated by the river and harbor act approved June 13, 1902.

The total expenditures to June 30, 1903, under the existing project amount to \$17,715.31. The channel proposed by this project has now been completed to full dimensions from the head of navigation at Exeter down to the mouth of the river, including a turning basin at Exeter, making an available depth of 11 feet to the town wharves.

The commerce involved in this improvement consists principally of coal for local consumption, a total of about 10,000 tons being reported annually.

July 1, 1902, balance unexpended	\$7,096.97
June 30, 1903, amount expended during fiscal year	5,812.28

July 1, 1903, balance unexpended	1,284.69
July 1, 1903, outstanding liabilities	537.41

July 1, 1903, balance available	747.28
---------------------------------------	--------

(See Appendix B 4.)

6. *Harbor of refuge at Little Harbor, New Hampshire.*—A survey was made of Little Harbor in 1882, and a plan of improvement proposed for the opening of an entrance channel with a depth of 9 feet at low tide and a width of 100 feet, together with a basin 300 by 700 feet, which was to be protected by a rubblestone breakwater. The estimated cost was \$33,000. This project was approved in 1886 and its execution entered upon. In 1887 the project was enlarged to provide for the construction of two breakwaters—one on the north, the other on the south side of the entrance to the harbor—and the dredging of an anchorage about 49 acres in extent in the protected area to a depth of 12 feet at mean low tide. The estimated cost of the enlarged project was \$235,000, and the act of 1888 made an appropriation for the work on the enlarged plan.

In October, 1894, after the breakwaters had been completed and a part of the dredging accomplished, the project was amended by reducing the area of the anchorage to be dredged to about 40 acres instead of 49. At the same time the project was revised and the cost of the entire work placed at \$145,000.

Before improvement the depth in the harbor was only about 6 feet at low tide, and the anchorage was small and exposed.

The total expenditures up to June 30, 1903, amount to \$131,710.43.

Both breakwaters have been completed and the anchorage has been dredged to full projected width and depth, the dredging being completed during June, 1903, making an available depth over the anchorage of 12 feet at mean low water. It is proposed to apply the balance

of the funds in hand, or so much thereof as may be necessary, to the repair of the breakwaters which have been damaged in places by storms.

July 1, 1902, balance unexpended.....	\$13, 295. 82
June 30, 1903, amount expended during fiscal year.....	6. 25
July 1, 1903, balance unexpended.....	13, 289. 57
July 1, 1903, outstanding liabilities.....	2, 836. 75
July 1, 1903, balance available.....	10, 452. 82

(See Appendix B 5.)

7. *Newburyport Harbor, Massachusetts.*—Newburyport, Mass., is situated about 2½ miles from the Atlantic Ocean on the south bank of Merrimac River. The river empties into the Atlantic Ocean midway between Cape Ann and Portsmouth, or about 30 miles a little east of north from Boston in a direct line.

The outlet of the river between Plum Island and Salisbury Point is 1,000 feet wide and 30 feet deep at mean low water. At a distance of nearly a mile outside lies a sandy bar, thrown up by wave action, through which, previous to the improvement, a channel, variable in position and depth, was maintained by the current of the river, increased by the tidal flow in a large interior basin through a mean range of tides of 7.7 feet. For 1,000 feet outward from the gorge toward the crest of the bar the current was able to maintain a channel of navigable width and 18 feet deep at mean low water, and for a further distance of 1,500 feet a channel 12 feet deep. From the 18-foot contour line on the inside to the same on the outside the distance was 4,000 feet, and between the 12-foot contours the distance was 3,000 feet. The depth over the crest of the bar was originally but about 7 feet, and the channel was narrow and shifting.

The object of the improvement is to create through the outer bar a channel 1,000 feet wide and at least 17 feet deep at mean low water, so that vessels may cross the bar and find a harbor at any stage of the tide with as great draft as can reach Newburyport by the river at high tide. The project submitted September 16, 1880, proposed two converging rubblestone jetties, their outer ends 1,000 feet apart and to be extended parallel to the axis of the channel, if necessary, and the protection of the beach in their vicinity, at a cost, as estimated in 1881, of \$365,000. The direction of jetties and shore protection was modified in 1883, and in 1882 the partial closing of Plum Island Basin with a timber dike about 800 feet long and 5½ feet above mean low water was added to the project, increasing the cost to \$375,000, as estimated in 1884.

In 1884 a modification of project provided for extension of both jetties parallel to the axis of the channel for a distance of 610 feet, and in 1886 the length of extension was increased to 1,000 feet, increasing the cost of the work, as estimated in 1897, \$224,547.49. (Annual Report of the Chief of Engineers for 1897, p. 825.)

Both jetties are 15 feet wide on top—which is in a plane 12 feet above mean low water—and have slopes of 1 on 2 on the sea side and 1 on 1 on the shore side.

A map showing the location of the jetties is published in the Annual Report of the Chief of Engineers for 1885, opposite page 494.

The total expenditures to June 30, 1903, amount to \$335,746.67. The north jetty is completed for a total length of 2,705 feet and the

south jetty for 2,050 feet. The Plum Island dike is 817 feet long, 5½ feet high above mean low water, except near the middle, where a weir 150 feet long and 2 feet above mean low water was left temporarily. The sand catch in rear of the south jetty is in two branches, one 480 feet long and one 572 feet long.

No work was in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1902.

The river and harbor act of June 13, 1902, appropriated \$30,000 for the continuation of this improvement. It is proposed to apply these funds, together with a balance of \$2,500 not required for the removal of North Rock, to such repairs to the jetties as may be necessary and to the extension of the south jetty as far as available funds will permit.

The breakwater work was advertised January 17, 1903, but the only proposal received was rejected as being too high. Readvertisement of the work will be deferred until next year.

A survey made during June, 1901, shows that there has been some improvement in the depth on the bar, the controlling depth in 1901 being 12.6 feet at mean low water as against 11 feet at mean low water in 1899, when the last previous survey was made. The channel had moved slightly to the north of its 1899 position, but retained about the same width as it had at that time.

The commerce reported for this port for the last four years is as follows:

	Tons.
1899.....	180,600
1900.....	128,440
1901.....	183,000
1902.....	107,135
July 1, 1902, balance unexpended	\$32,945.63
June 30, 1903, amount expended during fiscal year	192.30
July 1, 1903, balance unexpended	32,753.33
{ Amount (estimated) required for completion of existing project	234,047.49
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 6.)

8. *Merrimac River, Massachusetts.*—The mouth of the Merrimac River is 15 miles northwest from Cape Ann, Massachusetts. Tide water extends up it a distance of 21½ miles, or to the foot of the Upper Falls, 1½ miles above Haverhill, Mass.

Seven incorporated cities and the largest mills in New England are directly interested in this improvement.

Before improvement the channel was narrow and crooked and much obstructed by ledges, bowlders and shoals. At mean low water vessels drawing not to exceed 7 feet could enter the river and proceed to South Amesbury, 9 miles from the mouth.

The mean rise and fall of the tide at the mouth is 7.7 feet; at Haverhill Bridge, 4.6 feet at low-water stage of the river.

Since 1828 the channel of the river has been improved under a succession of projects, the principal one (dated 1870 and modified in 1874) providing for a channel with the following depths at ordinary high-water stages of the river: From the mouth to Deer Island Bridge, 5

miles, 16½ feet; thence to Haverhill Bridge, 12½ miles, 12 feet; thence to the foot of Mitchells Falls, Hazeltine Rapids, 1½ miles, 10 feet; thence through Mitchells Falls to the head of the Upper Falls, 2½ miles, not less than 4½ feet when the mill water at Lawrence is running. On June 30, 1894, the improvement of the river in accordance with these projects had been completed. Since that date the river has apparently shoaled to some extent in places.

The river and harbor act of June 3, 1896, appropriated \$5,000 for the removal of "certain rocks below Rock Bridge," and in 1896-97 the channel at that point was cleared of obstructing bowlders, a total of about 1,060 cubic yards being removed.

The total cost of the work under the foregoing projects was \$247,366.72.

The present approved project, submitted May 5, 1897, provides for a channel 7 feet deep at mean low water and 150 feet wide (ordinary low-water stage of the river) from Newburyport to Haverhill, at an estimated cost of \$171,442.70. This project is published in the Annual Report of the Chief of Engineers for 1897, page 865.

The river and harbor act of March 3, 1899, appropriated \$40,000 for the improvement of the river under the new project. Dredging was continued during the past fiscal year under this appropriation and at the close of the fiscal year the 150-foot channel had been completed to 7 feet depth at mean low water from a point near the head of Porter Island for a distance of about 10,600 feet down river to a point near Rock Bridge.

The total expenditures on the existing project up to June 30, 1903, amount to \$56,427.39.

The maximum draft that can be carried, June 30, 1903, to the wharves at the head of navigation at Haverhill at mean low water is about 5 feet.

The commerce of the river is in coal, lumber, etc., for the cities and towns along its banks, the amount of coal reported in 1899 being 52,000 tons; in 1900, 60,000 tons; in 1901, 60,000 tons, and in 1902, 29,901 tons.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$50,882.71
June 30, 1903, amount expended during fiscal year	27,310.10
July 1, 1903, balance unexpended	23,572.61
July 1, 1903, outstanding liabilities	8,608.88
July 1, 1903, balance available	14,963.73
July 1, 1903, amount covered by uncompleted contracts	8,941.75
{ Amount (estimated) required for completion of existing project	91,442.70
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 7.)

9. *Powow River, Massachusetts.*—Powow River is a tributary of the Merrimac River, which it enters from the north about 3½ miles above

Newburyport. From its mouth tide water extends 9,600 feet in a channel which in its original condition was narrow and crooked and not navigable at low water.

The project proposed for its improvement is to dredge a channel 9,600 feet long, 60 feet wide, and 12 feet deep at mean high water, estimated in 1897 to cost \$100,000. (Annual Report of the Chief of Engineers for 1897, p. 829.) The object of the improvement is to secure a navigable low-water channel to the wharves at Amesbury.

The expenditures to June 30, 1903, were \$50,940.72. At that date the projected 9,600-foot channel was 12 feet deep at mean high water, 45 feet wide from Amesbury to the mouth of the river except for a distance of 650 feet at the lower end, where it was 30 feet wide.

The maximum draft that can be carried June 30, 1903, at mean low water to the wharves at the head of navigation at Amesbury is 6 feet. The mean rise and fall of tide is 6.7 feet.

No operations were in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1902.

The commerce of the river is in coal for local consumption, about 5,000 tons being reported annually

July 1, 1902, balance unexpended	\$59.28
July 1, 1903, balance unexpended	59.28

{ Amount (estimated) required for completion of existing project	49,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 8.)

10. *Harbor of refuge, Sandy Bay, Cape Ann, Massachusetts.*—Sandy Bay is situated at the northeastern extremity of Cape Ann, Massachusetts. It is about 2½ miles by 2 miles in area, and is fully protected on the west and south by high hills, but fronts the northeast and is open to the full effects of easterly and northeasterly gales. The great seas of the ocean are broken, however, in a degree by the sunken rocky ledges called Averys Ledge, the Dry and Little Salvages, the Flat Ground, and Abners Ledge, which are directly at the mouth of the bay. Inside these entrance ledges the bay is entirely unobstructed and has an average depth of 50 feet at mean low water. The shore lines of Sandy Bay form a little less than a right angle, and their directions are nearly north and south and east and west. The rocky island of Straitsmouth forms the eastern extremity of one shore line and the steep headland of Andrews Point the northern end of the other.

The proposed improvement contemplates the construction of a national harbor of refuge of the first class. The anchorage covered by the breakwater will contain 1,377 acres, in which the depth exceeds 24 feet at mean low water.

The estimated cost of the improvement was \$5,000,000. The original project of 1884 proposed a continuous breakwater 9,000 feet long, divided into two branches. One branch starts at Averys Ledge and runs in a direction a little west of north to Abners Ledge, a distance of 3,600 feet; the other extends 5,400 feet from Abners Ledge in a northwesterly direction and terminates at the 84-foot contour off Andrews Point.

The axis of the proposed breakwater is approximately at the inner edge of the ledges at the entrance of the bay and about 1 mile inside the Salvages and Flat Ground, which receive the first shock of easterly storm waves.

The southern entrance to the proposed harbor lies between Straitsmouth Island and Averys Ledge, and is to be 1,800 feet wide and at least 30 feet deep. The northern entrance, near Andrews Point, is 2,700 feet wide and 80 feet deep. They are so located with reference to each other that vessels can enter and leave the harbor with any wind.

The substructure in the original project was to consist of a mound of rubblestone to a grade of 22 feet below mean low water, 40 feet wide on top, to be surmounted by a masonry wall.

On March 2, 1892, the project was modified in accordance with a report of a Board of Engineers. The project as modified proposed to construct the entire breakwater of rubblestone, with the following section: On the sea side, from the bottom to 15 feet below mean low water, a slope of 1 on $1\frac{1}{2}$; thence to mean low water, 1 on 3; thence to 18 feet above mean low water, 1 on 1; the width on the crest, 20 feet, and the rear slope, 1 on 0.73, to mean low water; thence to the bottom, 1 on 1; the portion below low water to be built of stone of less than 4 tons weight, the upper portion of stone averaging 6 tons weight.

A plan of the bay, showing the proposed breakwater, is published in the Annual Report of the Chief of Engineers for 1892, page 564.

The act of March 3, 1899, required the Secretary of War to appoint a Board of officers to examine and report upon the project for this work, and the act of June 13, 1902, directed that no part of the amount appropriated by that act be expended until "said project shall have been examined by a Board of Engineers and a favorable report made by them upon the feasibility and advisability of continuing said project to completion." A favorable report was made September 18, 1902, by the Board appointed in accordance with this latter act, and this report is printed herewith in Appendix B 9.

The Board appointed in accordance with the act of March 3, 1899, modified the proposed cross section of the breakwater and placed the estimate of cost at \$5,891,832.70. The report of this Board is published in the Annual Report of the Chief of Engineers for 1900, page 1184, and also in House Document No. 453, Fifty-sixth Congress, first session, in the latter with a map showing the proposed cross section of the breakwater. By the terms of the act of June 13, 1902, this project was adopted, when the favorable report of the Board appointed under said act of 1902 was submitted.

The total expenditures to June 30, 1903, were \$1,176,298.04. At that date 1,542,298 tons of rubblestone had been placed in the breakwater, 137,682 tons of which was deposited during the past fiscal year, and its condition was approximately as follows:

Southern arm.—This arm has been built up to mean low-water level with the exception of about 70 feet at the end near Averys Ledge, where nothing has been done, and 540 feet near the angle, where it has been built up to about 5 feet above mean low-water level. The substructure is completed to full cross section for 1,700 feet from the angle and nearly completed for the next 1,830 feet, i. e., as far as any work has been done.

Western arm.—The substructure of this arm has been completed (elevation of top of substructure — 12) for a distance of 875 feet from the angle, with the exception of a small bench on the inner slope 13 feet deep and 16 feet wide, left to facilitate placing the superstructure; a core of the superstructure has been built for a distance of 900 feet from the angle, 400 feet of this being to mean high-water level, 12 feet wide on top, and the balance to mean low-water level, 30 feet wide on top; and more or less stone has been deposited in the substructure out to a point 1,750 feet from the angle.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are increased safety to life and property and a consequent reduction in freight and insurance.

July 1, 1902, balance unexpended.....	\$277, 503. 17
June 30, 1903, amount expended during fiscal year.....	103, 801. 21
July 1, 1903, balance unexpended.....	173, 701. 96
July 1, 1903, outstanding liabilities.....	8, 997. 88
July 1, 1903, balance available.....	164, 704. 08
July 1, 1903, amount covered by uncompleted contracts	155, 278. 87
{ Amount (estimated) required for completion of existing project.....	4, 541, 832. 70
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	300, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 9.)

11. Harbor at Rockport, Mass.—Rockport, Mass., is situated about 37 miles northeast of Boston, Mass., upon the northeastern shore of the rocky promontory of Cape Ann, which forms the northern limit of Massachusetts Bay. The town extends along both shores of Sandy Bay, which is open to the full sweep of storms from north around to east.

The shores of Sandy Bay are rock bound, and in their natural state furnish no sheltered anchorage, making it necessary to construct artificial harbors to provide shelter for vessels engaged in the commerce of this port. Piers for this purpose were constructed at Rockport by private enterprise in 1811 to 1817, and breakwaters were built at this point by the United States in 1836 to 1847, at a cost of \$69,082.57. The harbor is a natural cove, with its area somewhat enlarged by the projection of the main breakwater into the bay, and includes an area of about 15 acres. The main breakwater extends from Bear Skin Neck in an easterly direction. It is about 900 feet long, of which about 375 feet at the shore end is in good condition. The outer end of this portion is 71 feet wide and about 22 feet above mean low water. The outer portion of the breakwater, about 525 feet in length, has been badly damaged by the sea, and no traces remain of any regularity of form of construction. It consists of an irregular mound of rubble-stone, about 125 feet wide between low-water lines. At extreme high tides about 400 feet of it is submerged, and in easterly storms the sea sweeps over it throughout its length.

A small breakwater extends northward from Norwoods Head about 200 feet, leaving an entrance channel 220 feet wide between the low-

water lines of the two breakwaters. The smaller breakwater has been almost totally destroyed by the sea, and in its present condition consists of an irregular pile of rubblestone, spread over an area about 200 feet square. At the shore end a section of sea wall about 100 feet long still stands, with its crest about 25.4 feet above mean low water.

An examination and survey of the piers and breakwaters at Rockport was made in 1900, and the report thereon, which contains a detailed description and a map of the harbor, is printed as House Document No. 363, Fifty-sixth Congress, first session, and is also published in the Annual Report of the Chief of Engineers for 1900, page 1177.

The river and harbor act of June 13, 1902, appropriated \$22,000 for completion of the improvement of the breakwaters and piers in accordance with the report submitted in House Document No. 363, above referred to. The existing project, adopted June 13, 1902, proposes to build both breakwaters with rubblestone to the height of 10 feet above mean high water, with a seaward slope of 1 on 2, a harbor slope of 1 on 1, and a width on top of 20 feet, and the removal of the principal rocks in the harbor, at an estimated cost of \$22,481.80.

The total expenditures to June 30, 1903, were \$1,318.67. At that date 1,332 tons of rubblestone had been placed in the breakwater on Bear Skin Neck, and the condition of the work was as follows:

Bear Skin Neck breakwater was completed for a distance of 160 feet, up to its projected height of 18.5 feet above mean low water.

The commerce of this harbor is in supplies of coal, etc., for local consumption, in fish, and in large shipments of granite from the numerous quarries situated on the shores of Sandy Bay. An approximate estimate of the annual value of this commerce is \$820,000.

July 1, 1902, balance unexpended	\$22,000.00
June 30, 1903, amount expended during fiscal year	1,318.67
July 1, 1903, balance unexpended	20,681.33
July 1, 1903, outstanding liabilities	1,763.37
July 1, 1903, balance available	18,917.96
July 1, 1903, amount covered by uncompleted contracts.....	17,443.04

(See Appendix B 10.)

12. *Harbor at Gloucester, Mass.*—Gloucester Harbor, an important center for the fishing fleet of New England, is about 20 miles north of Boston. Its inner harbor was originally obstructed by sunken rocks and shoals, and the approaches to the wharves were shallow, varying from 1 to 12 feet. The outer harbor was open to all southerly gales.

In 1871 a project was adopted for the removal of certain bowlders from the inner harbor and the construction of a breakwater from Eastern Point over Dog Bar to Round Rock Shoal. The only work done under this project was the removal of bowlders at a cost of \$10,000, appropriated by the act of June 10, 1872. This work was completed in 1873.

In 1884 a project was adopted providing for two breakwaters at the entrance of Gloucester Harbor, one to cost \$752,000, on essentially the same site as that proposed in 1871, and a supplementary one through Normans Woe Rock, to cost \$607,000.

In 1887 a general project based on the survey provided for by the act approved August 5, 1886, for the improvement of this harbor was submitted. This project proposed to remove from the inner harbor 101½ cubic yards of rock known to exist, and to dredge 216,000 cubic yards, scow measurement, at an estimated cost of \$65,000, and to construct the breakwater from Eastern Point to Round Rock Shoal at an estimated cost of \$752,000, as recommended in the project of 1884.

The river and harbor act of June 3, 1896, authorized the removal of a pinnacle rock in the outer harbor to a least depth of 16 feet below mean low water, and rocks off the ferry landing at Rocky Neck to a level of the surrounding bottom.

On December 18, 1897, a revised project for the construction of the breakwater was submitted. This project proposed to build the substructure of the breakwater of rubblestone up to mean low water and 31 feet wide at that grade, to be surmounted by a superstructure formed of two dry walls of heavy split stone laid with the greatest dimension at right angles to the axis of the breakwater, the interior space to be filled with rubblestone and to be capped by heavy stone, forming a top course 10 feet in width. The project was estimated to cost \$698,083.43.

The river and harbor act approved June 13, 1902, appropriated \$75,000 for continuing the improvement of Gloucester Harbor, and placed the improvement under the continuous-contract system, limiting the total cost to \$227,083 in addition to the amount appropriated by that and previous acts.

The act further provided:

That the existing project may be modified so that the breakwater now under construction shall terminate at or near a ledge known as Cat Ledge, about two thousand two hundred and fifty feet from the shore, and the remainder of this appropriation and of the amount herein authorized not required for construction of said breakwater shall be applied toward the work of removing Round Rock, in said harbor.

The total expenditures under the existing project and its modifications to June 30, 1903, were \$183,020.05.

The following results have been accomplished: All the proposed dredging and rock removal, except that authorized by the act of June 13, 1902, have been done, and the breakwater completed for a distance of 277 feet from the shore, with an additional length of 1,373 feet of the substructure completed and 206 feet of the superstructure partly completed.

The work in its present stage has greatly benefited the fishing industry, and its completion will furnish much-needed sheltered anchorage in this important harbor.

A line of passenger and freight steamers is operated continuously throughout the year, and other commerce exists in the form of imports of salt, coal, lumber, etc. The estimated value of this commerce is \$5,000,000 annually.

The following gross tonnage of shipments and receipts is reported for the past six years:

	Tons.		Tons.
1897	82, 600	1900	267, 475
1898	86, 050	1901	283, 684
1899	287, 922	1902	285, 736

July 1, 1902, balance unexpended	\$78, 128. 20
Amount appropriated by sundry civil act approved March 3, 1903	60, 000. 00
	138, 128. 20
June 30, 1903, amount expended during fiscal year	2, 148. 25
	135, 979. 95
July 1, 1903, balance unexpended	135, 979. 95
July 1, 1903, outstanding liabilities	11, 963. 31
	124, 016. 64
July 1, 1903, balance available	124, 016. 64
	259, 150. 09
July 1, 1903, amount covered by uncompleted contracts	259, 150. 09
	167, 083. 00
{ Amount (estimated) required for completion of existing project	167, 083. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	167, 083. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 11.)

13. *Harbor at Manchester, Mass.*—Manchester Harbor is situated about $5\frac{1}{2}$ miles northeast from the entrance of Salem Harbor, Massachusetts. The channel was 100 feet wide and $6\frac{1}{2}$ feet deep at mean low water up to Proctors Point. It then shoaled rapidly to a depth of $1\frac{1}{2}$ feet at the Narrows, 1,400 feet from Proctors Point, and for a farther distance of 2,500 feet to the town wharves no low-water channel existed.

The original project, that of 1887, proposed to dredge a channel 60 feet wide, 4,000 feet long, and 4 feet deep at mean low water from Proctors Point to the town wharves. This project was completed in April, 1894, at a cost of \$14,300, giving a channel of full projected width and depth, with an additional width of 80 feet opposite the town wharf.

A chart of the harbor is published in the Annual Report of the Chief of Engineers for 1888, page 466.

The present approved project of improvement was adopted March 3, 1899, and is printed in the annual report for 1897, page 869. It proposes to dredge the natural channel to a least width of 75 feet, and two turning basins, one just below the railroad bridge and one at the town landing, all 6 feet deep at mean low water, at an estimated cost of \$25,000.

The amount expended on existing project to June 30, 1903, is \$4,853.33. The channel has been completed from the 6-foot contour in the bay up to a point northwest of Proctors Point, a distance of 3,200 feet, except over two small ledges which project into the channel about 20 feet on the eastern side about west of Proctors Point.

No operations have been in progress during the past fiscal year.

The available depth at mean low water that can be carried up to the town wharves is about 2 feet.

The river and harbor act of June 13, 1902, appropriated \$5,000 for continuation of this improvement. Work under this appropriation will be done during the present season upon the completion of dredging in Beverly Harbor, Massachusetts.

The commerce involved in this improvement consists of supplies of coal, lumber, etc., for local consumption, about 10,000 tons being reported received in 1899, 12,000 in 1900, 5,800 in 1901, and 3,600 in 1902.

July 1, 1902, balance unexpended	\$5,252.22
June 30, 1903, amount expended during fiscal year	105.55
July 1, 1903, balance unexpended	5,146.67
July 1, 1903, outstanding liabilities	55.63
July 1, 1903, balance available	5,091.04
July 1, 1903, amount covered by uncompleted contracts.....	4,500.00
{ Amount (estimated) required for completion of existing project	15,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B 12.)

14. *Harbor at Beverly, Mass.*—Beverly Harbor is a small harbor at the western end of Salem Bay and immediately adjacent to Salem Harbor on the south, from which it is separated by Salem Neck. It is formed by the confluence of the three branches of a tidal inlet, called, respectively, North River, Essex Branch, and Beverly Creek.

A full description of the harbor may be found in the Annual Report of the Chief of Engineers for 1890, Part I, page 524, and is also published, with map, in House Ex. Doc. No. 27, Fifty-first Congress, first session.

The river and harbor act of June 13, 1902, appropriated \$10,000 for completing this improvement in accordance with the report submitted in House Doc. No. 129, Fifty-sixth Congress, second session (see Annual Report of the Chief of Engineers for 1901, p. 1065). This is the first appropriation made for the improvement of this harbor.

From a survey made in September, 1900, it was found that the harbor has an available channel of 18 feet depth at mean low water to the wharves of the town, but that this channel is so narrow at certain points as to make it difficult to take heavy vessels through without touching on one side or the other.

The proposed improvement consists in widening the present channel at certain points so as to give a clear channel width of about 200 feet, at an estimated cost of \$10,000.

The amount expended to June 30, 1903, is \$99.31.

A contract for the completion of the dredging has been entered into.

It has been impracticable to obtain reliable commercial statistics prior to 1901, when a total of 47,378 tons was reported, and in 1902, 53,142 tons.

July 1, 1902, balance unexpended	\$10,000.00
June 30, 1903, amount expended during fiscal year.....	99.31
July 1, 1903, balance unexpended	9,900.69
July 1, 1903, outstanding liabilities	94.53
July 1, 1903, balance available	9,806.16
July 1, 1903, amount covered by uncompleted contracts	6,075.00

(See Appendix B 13.)

15. *Repair of sea wall at Marblehead, Mass.*—Marblehead, Mass., is about 12 miles north of Boston, Mass. A part of the town is situated on Marblehead Neck, a peninsula lying east of the mainland and connected therewith by an isthmus about 2,000 feet long and a least width

of 105 feet between high-water lines, which forms the southern boundary of Marblehead Harbor.

This isthmus is traversed by a highway, which is protected for about 1,900 feet of its length by a sea wall of light construction, reported to have been built by the United States Government in the early part of the last century.

A survey of the isthmus was made in September, 1896, and a report and plan of this survey were submitted to the Department on February 4, 1897, and are published in House Document No. 289, Fifty-fourth Congress, second session; also in the Annual Report of the Chief of Engineers for 1897, page 870.

The river and harbor act of March 3, 1899, appropriated \$1,000 for the repair of the sea wall at Marblehead, made necessary by the great storm of November, 1898.

An examination of the sea wall was made in November, 1899, at a cost of \$8.33. The wall seems to have served its purpose since its construction without sustaining any damage worth mentioning, and there was apparently no need of any repairs at the time of the examination.

The river and harbor act of June 13, 1902, directed a survey and estimate of cost to be made of a breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck, with a view to protecting the causeway from destruction or injury by the sea, and report thereon is submitted herewith in Appendix B 20.

July 1, 1902, balance unexpended	\$991. 67
July 1, 1903, balance unexpended	991. 67

(See Appendix B 14.)

16. *Channel between North and South Hero islands, Lake Champlain, Vermont.*—In its original condition this channel was obstructed at its western entrance by a bar through which the channel was but 40 feet wide and 7 feet deep and at its eastern entrance by a bar through which the channel was 100 feet wide and 8 feet deep.

The only appropriation for this work, \$10,000, was made by the river and harbor act of August 11, 1888, which adopted a project to dredge the channel at the two entrances to a width of 150 feet and depth of 10 feet. This appropriation was expended in the following year and the channel reported as completed.

In 1897 it was reported that there was a good channel at the eastern entrance of the depth and width prescribed in the project, but at the western entrance there was a troublesome bowlder in mid-channel and the channel was 1 to 2 feet shallower in the middle, 2 to 4 feet shallower at its edges, and 25 feet narrower than the project prescribed.

With the appropriation asked for the fiscal year ending June 30, 1905, it is proposed to continue work on the existing project by widening and deepening the channel to the limits authorized and also remove the bowlder at the western entrance. This work will require the removal of about 4,000 cubic yards of bowlders, etc., at an estimated cost of \$1 per cubic yard, the balance to be applied to engineering expenses.

{ Amount (estimated) required for completion of existing project	\$4, 300. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905.	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

17. *Harbor at Burlington, Vt.*—This harbor is situated on the eastern shore of Lake Champlain. In its natural condition ample depth

of water existed along its docks and wharves, which were, however, unprotected from the severe storms crossing the lake. The greatest exposure is from the prevalent northwesterly gales, which have a sweep of 15 miles obliquely across the lake.

The original project for improvement, adopted in 1836, provided for the forming of an artificial harbor in front of the city by constructing a breakwater parallel with the shore and about 1,000 feet distant from the docks and wharves. Work commenced in 1836 and continued at intervals until 1857, when 1,069 linear feet of breakwater had been completed.

In 1867 a Board of Engineers, convened to consider the location and construction of breakwater, recommended that the one previously constructed be extended northward 1,500 feet. Of this extension 831 linear feet was built, and, in addition, 617 linear feet was added at the south end, making its total length 2,517 feet at the close of the fiscal year 1874.

In June, 1874, a plan was adopted for an extension northward of the breakwater for a farther distance of 2,000 feet, the cost being estimated at \$340,000. (See Annual Report of the Chief of Engineers for 1874, p. 275.)

In 1884 extensive repairs were begun to the portion of the breakwater built between 1836 and 1857.

On September 28, 1886, a project was approved extending the breakwater 500 feet northerly and 1,000 feet southerly, keeping the line generally at a distance of from 800 to 1,000 feet from the line of the wharves, at an estimated cost of \$150,000, and on August 24, 1894, the project was again amended so as to provide for replacing 3,800 linear feet of the decayed and dilapidated wooden superstructure of the breakwater with one of stone or concrete, at an estimated cost of \$173,750.

Further description and history of the work may be found in the Annual Report of the Chief of Engineers for 1897, Part IV, page 3296.

The amount expended on original and modified projects prior to operations under existing project was \$501,811.07.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, was \$113,488.69.

At the time of the adoption of the project of 1886 a breakwater 3,560 feet long had been built. From 1886 to June 30, 1903, 1,670 linear feet of wooden superstructure on old sections of the breakwater had been replaced by superstructure of stone or concrete, and 600 linear feet of new breakwater, varying in width from 24 to 36 feet, had been built, making the total length of the breakwater 4,160 feet. This superstructure affords protection to nearly all the docks and wharves along the harbor front.

The maximum draft that can be carried to the docks and wharves on June 30, 1903, is 11 feet at mean low water.

The river and harbor act of June 13, 1902, appropriated \$57,750 for the repair and maintenance of this breakwater. A contract for the work has been made, and work will be commenced as soon as the water level of the lake subsides enough to permit it.

The principal items of commerce at this port are coal, lumber, stone, and general merchandise, the following tonnage being reported for the past six years:

	Tons.		Tons.
1897.....	109, 180	1900.....	131, 226
1898.....	116, 527	1901.....	108, 234
1899.....	87, 630	1902.....	102, 825
July 1, 1902, balance unexpended.....			\$58, 087. 94
June 30, 1903, amount expended during fiscal year.....			76. 63
July 1, 1903, balance unexpended.....			58, 011. 31
July 1, 1903, outstanding liabilities.....			181. 99
July 1, 1903, balance available.....			57, 829. 32
July 1, 1903, amount covered by uncompleted contracts.....			54, 103. 00
{ Amount (estimated) required for completion of existing project.....			161, 855. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....			40, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.			

(See Appendix B 15.)

18. *Otter Creek, Vermont.*—This creek flows into Lake Champlain from its eastern shore. In its natural condition the channel was narrow and tortuous in places, and the available depth from Vergennes to the mouth—a distance of 8 miles—was less than 6 feet.

The original project, adopted in 1872, proposed the formation of a channel 100 feet wide and 8 feet deep from Lake Champlain to Vergennes, and also of a basin at this latter point, at an estimated cost of \$58,146. (See Annual Report of the Chief of Engineers for 1872, p. 273.)

In 1882 the project was modified to provide for the removal of rock at the steamboat landing near Vergennes, which increased the cost to \$73,748.40. (See Annual Report of the Chief of Engineers for 1882, p. 711.)

In addition, an annual expenditure estimated at \$1,000 will be required for maintenance after completion of the work.

A detailed statement of the work done prior to June 30, 1897, may be found in the Annual Report of the Chief of Engineers for 1897, page 3299.

The amount expended to June 30, 1903, was \$62,500. The condition of the channel at that date was such as to allow boats drawing 8 feet of water to navigate between Lake Champlain and Vergennes during the entire season.

No work was done during the last fiscal year.

The maximum draft that could be carried to the head of navigation at Vergennes on June 30, 1903, was 8 feet at mean low water.

The commerce of this creek consists of coal, lumber, iron, kaolin, and general merchandise, the amounts reported in recent years being as follows:

	Tons.		Tons.
1896.....	9, 052	1900.....	8, 090
1897.....	7, 680	1901.....	5, 760
1899.....	7, 200	1902.....	2, 790
{ Amount (estimated) required for completion of existing project.....			\$11, 248. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905.....			3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.			

(See Appendix B 16.)

19. *Harbor at Plattsburg, N. Y.*—The original project for the improvement of this harbor was probably adopted in 1836, the date of the first appropriation, and proposed the construction of a breakwater about 1,000 feet east of the steamboat wharves. Between 1836 and 1875 a total of about 1,250 linear feet of breakwater was constructed.

A modification of the project made in 1870 provided for the extension of the former structure southeastward, the dredging of some shoal areas within the breakwater, and the protection of a portion of the adjacent beach by revetment.

After the completion of the project of 1870 operations were confined to necessary repairs and the dredging of limited areas near the steamboat docks.

The act of September 19, 1890, appropriated \$32,500 for completion of the improvement, and made provision for a northward extension to the breakwater of 300 feet and for replacing by a stone parapet the crib superstructure of the older part. Under this appropriation the project was completed in January, 1893, since which time no work on this improvement has been done. The breakwater as completed is 1,565 feet in length. Some dredging has been done in the anchorage and a short length of beach has been protected.

The total cost of the work to June 30, 1903, is \$185,698.92.

The river and harbor act of June 13, 1902, appropriated \$5,000 for the improvement of this harbor, for maintenance and restoration.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	258.16

July 1, 1903, balance unexpended	4,741.84
--	----------

(See Appendix B 17.)

20. *Narrows of Lake Champlain, New York and Vermont.*—In its original condition the 15 miles of this waterway, extending from the northern terminus of Champlain Canal, at Whitehall, northerly to Benson Landing, Vt., had a very narrow and tortuous channel, not more than 9½ to 10 feet deep on the shoals at low water.

The original project, adopted in 1886, was to obtain a channel having a least width of 150 feet and depth of 12 feet at low water from the northern terminus of the Champlain Canal, at Whitehall, N. Y., to deep water in Lake Champlain, below Benson Landing, Vt., a distance of 15 miles, at an estimated cost of \$80,000. (See Annual Report of the Chief of Engineers for 1885, pp. 2312-2314.)

Work under this project was completed in September, 1889, at a little more than half its estimated cost, owing to the low prices paid for dredging.

In 1890 a supplemental project was prepared for widening and straightening the middle reaches of the channel, at an estimated cost of \$21,000. (See Annual Report of the Chief of Engineers for 1890, p. 2884.) This project was adopted in 1892 and work completed under it in August, 1896.

In 1896 a project was prepared for restoring, widening, and deepening the channel, at an estimated cost of \$22,500, the cost of maintenance, after completion, being placed at \$2,500 annually. (See Annual Report of the Chief of Engineers for 1897, pp. 3302-3303.) This project was adopted in 1899.

The amount expended on the original project and its modifications, as given above, to June 30, 1903, was \$68,851.87, not including an

allotment of \$1,500 from the emergency river and harbor act of June 6, 1900, expended in 1900 in removing a shoal which had formed in Whitehall Harbor, restoring the area dredged to its former depth of 12 feet.

Before the commencement of work under the modified project of 1899 the channel, which had previously been dredged to 12 feet, had shoaled in places, restricting the draft that vessels could carry through it to not exceeding 10 feet.

Since then the shoal places in Kenyons Bay, opposite Pulpit Point and near the south end of the Narrows, have been redredged to a depth of 12 feet. This work increased the available depth for navigation from 10 to 12 feet. Booms have also been placed at and opposite Puts Rock in order to prevent vessels from colliding with the rocky bluffs at these points.

The river and harbor act of June 13, 1902, appropriated \$17,500 for this work, which will be applied to the completion of the improvement.

The maximum draft that can be carried June 30, 1903, is 12 feet at mean low water.

The tonnage passing through the Narrows consists of timber, pulpwood, salt, sugar, coal, stone, lime, clay, iron, and general merchandise, the amounts reported for the past six years being as follows:

	Tons.		Tons.
1897	519, 873	1900	714, 741
1898	498, 731	1901	550, 331
1899	848, 457	1902	395, 234
July 1, 1902, balance unexpended			\$17, 500. 00
June 30, 1903, amount expended during fiscal year			351. 87
July 1, 1903, balance unexpended			17, 148. 13

(See Appendix B 18.)

21. *Removing sunken vessels or craft obstructing or endangering navigation.*—During the fiscal year eight wrecks were removed from Lake Champlain at various points between Whitehall, N. Y., and Larabee Landing, Vt., under the provisions of the act of March 3, 1899, at a total cost of \$3,600.

(See Appendix B 19.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS SOUTH OF AND INCLUDING LYNN HARBOR.

This district was in the charge of Lieut. Col. W. S. Stanton, Corps of Engineers.

1. *Harbor at Lynn, Mass.*—An area of shoals extends from the wharves at Lynn $2\frac{1}{4}$ miles southerly to the sea. It is protected from the sea by the peninsula of Lynn Beach and Nahant.

In its original condition three narrow and crooked channels, in which the depth was but 6 feet at mean low water, extended from the wharves to the sea.

The original project, defined in the report of a Board of Engineers dated April 10, 1884, and as modified in 1888, was to dredge a channel 200 feet wide and 10 feet deep at mean low water from the sea (at White Rocks) a distance of 3,300 feet to a deep basin opposite Little Nahant, and from the basin nearly opposite Sand Point, a distance of 6,900 feet to a point 400 feet inside the harbor line, and an anchorage basin 500 feet by 300 feet and 10 feet deep at mean low water, the

upper part of the channel to be maintained by occasional dredging, the lower part by a training wall joining the land at Little Nahant, at an estimated cost of \$182,000.

The amount expended on this project to June 30, 1903, is \$122,063.56, all for improvement, with which the entire channel and the anchorage basin as prescribed in the project have been completed. The building of a training wall has not been commenced, because the necessity for its construction has not been apparent.

The existing project, adopted by the river and harbor act of June 13, 1902, is to dredge the channel 200 feet wide from the sea to the anchorage basin and the anchorage basin itself to the depth of 15 feet at mean low water, at an estimated cost of \$162,936.84. Under this project to the close of the fiscal year ending June 30, 1903, the amount expended, not including outstanding liabilities, is \$9,420.38, all for improvement, with which a channel has been obtained 15 feet deep at mean low water 100 feet wide and 2,600 feet in length from the deep basin opposite Little Nahant to a point 2,000 feet from that depth in the sea.

The maximum draft that can be carried June 30, 1903, over the shoalest part of the locality under improvement is 9.7 feet at mean low water. The mean range of tides is 9.3 feet.

The commerce of the harbor benefited by the improvement consists chiefly of coal, lumber, and building materials, of which about 587,039 tons was carried during the calendar year 1901, and 361,562 tons was carried during the calendar year 1902, a decrease of about 38 per cent. The improvement enables these supplies to be delivered at Lynn without breaking cargoes in Boston.

The original project approved by the Secretary of War April 21, 1884, is in the Annual Report of the Chief of Engineers for 1884, page 524, and the map of the harbor at page 532.

The existing project was published with map as House Document No. 78, Fifty-sixth Congress, second session, and without map in the Annual Report of the Chief of Engineers for 1901, page 1093.

PROJECT OF 1884 FOR 10-FOOT CHANNEL.

July 1, 1902, balance unexpended	\$6, 575. 26
June 30, 1903, amount expended during fiscal year	138. 82
July 1, 1903, balance unexpended	6, 436. 44
Amount (estimated) required for completion of existing project	53, 500. 00

PROJECT OF 1900 FOR 15-FOOT CHANNEL.

July 1, 1902, balance unexpended	\$25, 000. 00
June 30, 1903, amount expended during fiscal year	9, 420. 38
July 1, 1903, balance unexpended	15, 579. 62
July 1, 1903, outstanding liabilities	2, 672. 23
July 1, 1903, balance available	12, 907. 39
July 1, 1903, amount covered by uncompleted contracts	11, 717. 33

{ Amount (estimated) required for completion of existing project	137, 936. 84
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	40, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix C 1.)

2. *Mystic and Malden rivers, and Mystic River below the mouth of Island End River, Massachusetts.*—(a) *Mystic River.*—In its original condition, the Mystic had a practicable channel 6 feet deep at mean low water extending to Denning's landing, 3.9 miles above its mouth in Boston Harbor, and 4 feet deep at mean low water about 2,000 feet farther.

The original project for improvement, adopted by the act of July 13, 1892, which is also the present project, is to make the channel 100 feet wide and 6 feet deep at mean low water from the Boston and Maine Railroad (Western Division) bridge up about 1 mile to the first turn above Denning's wharf, and thence 2 miles to the head of navigation, at Medford, 4 feet deep at mean low water, gradually narrowing (from 100 feet) to 50 feet at the upper end, at an estimated cost of \$25,000.

The amount expended to close of the fiscal year June 30, 1903, is \$15,000. With this expenditure a channel 100 feet wide and 6 feet deep at mean low water has been completed to the full length prescribed in the project, and the improvement has been carried a farther distance of 4,200 feet with the width and the depth of 4 feet prescribed.

The maximum draft that can be carried, June 30, 1903, at mean low water is 6 feet up to the first turn above Denning's wharf, and thence to the head of navigation $1\frac{1}{2}$ feet. The mean range of tides is 9.8 feet.

The head of navigation is the upper limit of that part of the channel under improvement, at the stone bridge at Medford, to which point, 6 miles above its confluence with the Charles River in Boston Harbor, the stream is navigable in fact.

The commerce benefited by this improvement consists chiefly of coal and molasses, and amounted in the calendar year 1901 to 19,050 tons, and in 1902 to 3,500 tons.

A report, with map of the survey of Mystic River and description of the project is in the Annual Report of the Chief of Engineers for 1891, page 674.

(b) *Malden River.*—In its original condition the Malden has a practicable channel 4 feet deep at mean low water, extending only 2,000 feet above its confluence with the Mystic.

The original project, adopted by the act of August 12, 1882, was to make the channel 100 feet wide and 12 feet deep at mean high water to the second bridge, about 1.8 miles above its confluence with the Mystic, at an estimated cost of \$35,000.

The amount expended on the Malden River under the original project and prior to operations under the existing project was \$10,000, in obtaining a channel with a least width of 50 feet and 70 feet at turns, with a depth of 12 feet at mean high water from the mouth to the first bridge at Malden, a distance of $1\frac{1}{4}$ miles.

The existing project, adopted by the act of July 13, 1892, is to dredge a channel 12 feet deep at mean high water 100 feet wide to the first bridge, 1.6 miles above its confluence with the Mystic, and 75 feet wide about 1,200 feet farther to the second bridge, at an estimated cost of \$37,000.

The amount expended under the existing project to June 30, 1903, is \$22,650.72, of which \$7,664.33 was expended for maintenance.

With it a channel was obtained 100 feet wide and 12 feet deep at mean high water up to the first bridge. The local officer has reported the river above this point to be unworthy of improvement by the United States at this time.

The maximum draft that can be carried at mean high water, June 30, 1902, over the shoalest part of the improved channel is 10 feet. The mean range of tides is 9.8 feet.

The head of navigation is at the first bridge at Malden, to which point the stream is navigable in fact, 1.6 miles above its confluence with the Mystic River.

The commerce amounted to 61,600 tons in 1901, and to 80,700 tons in 1902, of coal, molding sand, and steel (calendar years).

A report of the survey of Malden River and description of the original project is on page 532, Annual Report of the Chief of Engineers for 1881.

The modifications of the project are stated in the Annual Report of the Chief of Engineers for 1900, page 1191.

The existing project is described on page 672, Annual Report of the Chief of Engineers for 1891.

(c) *Mystic River below the mouth of Island End River.*—Island End River is $1\frac{1}{4}$ miles above the mouth of the Mystic, at the navy-yard in Charlestown and 2,700 feet above the Chelsea drawbridge over the Mystic.

In its original condition the Mystic up to Island End River had a narrow channel 14.4 feet deep at mean low water, but so narrow above the drawbridge as to be barely practicable.

The original project, adopted by the act of March 3, 1899, which is also the existing project, is to dredge a channel 25 feet deep at mean low water and 300 feet wide, embracing 1.7 miles of the Mystic, extending from its mouth to a point 800 feet above Island End River, at a cost estimated in August, 1899, at \$267,547.50 (reduced estimate).

To June 30, 1903, \$66,752.96 (all for improvement, except \$281.92 for maintenance) has been expended obtaining a channel 25 feet deep at mean low water, with a minimum width of 100 feet up to Chelsea drawbridge and 150 to 300 feet in width from Chelsea Bridge to a point just above the confluence of the Island End River.

The commerce amounted to 1,430,650 tons in 1901, and 1,595,087 tons in 1902, of which 86 per cent was coal.

The maximum draft that can be carried June 30, 1903, over the shoalest part of the locality under improvement is 25 feet. The mean range of tides is 9.6 feet.

A report of the survey of the river was published in the Annual Report of the Chief of Engineers for 1899, page 1097. No map has been published.

July 1, 1902, balance unexpended.....	\$29,786.88
June 30, 1903, amount expended during fiscal year.....	19,190.56
July 1, 1903, balance unexpended.....	10,596.32
July 1, 1903, outstanding liabilities.....	1,972.50
July 1, 1903, balance available.....	8,623.82
July 1, 1903, amount covered by uncompleted contracts.....	2,880.00
(Amount (estimated) required for completion of existing project.....	224,547.50
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the bal- ance available July 1, 1903.....	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C 2.)

3. *Harbor at Boston, Mass.*—In its original condition the headlands and islands were without protection against the sea, which was extensively eroding them. Dangerous rocks obstructed the approach and entrance from Nantasket Roads to the lower main ship channel through the Narrows. That channel was 23 feet deep at mean low water with a least width of 150 feet. The upper main ship channel from President Roads to Boston had a least depth of 18 feet at mean low water with a least width of 100 feet. The channel from President Roads to Broad Sound in the ocean had a least depth of 29 feet at mean low water with a least width of 200 feet.

The original project, act of March 3, 1825, was "for the preservation of the islands in Boston Harbor necessary to the security of that place," and until 1866 all expenditures, amounting to \$546,526.10, appear to have been applied to that purpose in the building and repair of permanent sea walls. The amount expended upon them since 1866 can not be accurately stated.

The original project for the improvement of the harbor adopted by the act of March 2, 1867, was (as modified) to make the main ship channel from Nantasket Roads to Boston 23 feet deep at mean low water, 600 feet wide through the Narrows to President Roads, and 1,000 feet wide from President Roads to Boston.

Prior to operations under the existing project and to this date 3.75 miles of sea walls had been built, protecting the most exposed headlands and islands, and a channel had been completed 23 feet deep at mean low water from Nantasket Roads to Boston, with a least width of 625 feet in the Narrows and of 850 feet between President Roads and the city.

The amount expended on original and modified projects from 1825 to June 30, 1903, upon sea walls and channels, for improvement and maintenance, is \$2,351,307.95.

This amount is exclusive of all expenditures on the six existing projects, for the three harbor channels, and the three tributary channels, which follow:

The existing projects are—

1. Adopted by the river and harbor act of July 13, 1892. To widen the main ship channel, from Nantasket Roads to Boston, to 1,000 feet, and to deepen it to 27 feet at mean low water, at an estimated cost of \$1,250,000, subsequently increased to \$1,488,751.

2. Adopted by the river and harbor act of March 3, 1899. To widen the Broad Sound channel to 1,200 feet, and to deepen it to 30 feet at mean low water, at an estimated cost of \$455,000.

3. Adopted by the river and harbor act of June 13, 1902. To provide channels 35 feet deep at mean low water, 1,200 feet wide from the navy-yard at Charlestown and the Chelsea bridge and Charles River bridge to President Roads, and 1,500 feet wide from President Roads through Broad Sound to the ocean, at an estimated cost of \$7,994,248.68. This estimate differs from any made in the project quoted in the act as the basis of the appropriation, owing to the different width of the channels adopted. (To avoid a large amount of rock excavation the 35-foot channel from President Roads to Broad Sound is in a different location from the 30-foot channel.)

Project of July 13, 1892.—To June 30, 1903, \$1,144,699.97 has been expended, not including outstanding liabilities, with which expenditure the depth of the upper and lower main ship channels from Boston to the sea was increased 4 feet, to 27 feet at mean low water, and the width was increased 200 feet in the upper and 375 feet in the

lower channel to 1,000 feet throughout both channels, except over some rock ledges which are still to be removed.

Fifteen ledges that covered $2\frac{8}{10}$ acres and that contained 8,772 cubic yards of rock have been removed from the lower, and six groups of ledges that covered $1\frac{1}{10}$ acres and contained 3,477 cubic yards have been removed from the upper channel; totals, $3\frac{9}{10}$ acres and 12,249 cubic yards. Ledges still to be removed restrict the width of the channel, 27 feet deep at mean low water, to 500 feet in the upper and 330 feet in the lower channel.

The maximum draft that can be carried at mean low water June 30, 1903, over the shoalest part of the locality under improvement is, in the upper main ship channel from President Roads to Boston, 27 feet, and in the lower main ship channel, from President Roads to the sea, 25 feet.

A map of the project is in Annual Report of the Chief of Engineers for 1894, page 554.

Project of March 3, 1899.—From March 3, 1899, to June 30, 1903, \$298,991.56 has been expended, not including outstanding liabilities, with which expenditure a channel has been dredged with a minimum depth of 28 feet at mean low water and a least width of 1,000 feet from President Roads to the sea.

The project is published with map in House Doc. No. 133, Fifty-fifth Congress, second session, and without map in Annual Report of the Chief of Engineers for 1898, page 886.

Project of June 13, 1902.—To June 30, 1903, \$11,622.32 has been expended, not including outstanding liabilities, with which expenditure an area 1,400 by 150 feet has been dredged to the depth of 35 feet at mean low water, except an area of $2\frac{3}{10}$ acres where ledge has been uncovered.

The mean range of tides is 9.5 feet at Boston light and 9.6 feet in the upper harbor.

The foreign exports and imports for the port of Boston during the calendar year ended December 31, 1902, amounted in value to \$164,798,905, being an increase over the valuation in 1867, when the systematic improvement of the channels was begun, of \$98,192,284.

The entire cost of the improvement of the channels in Boston Harbor during that period is about 3 per cent of the increase in annual value of foreign commerce of the port since the improvement was begun, and is less than 2 per cent of the value of the present foreign commerce per year.

Tributary channels.—(a) *Charles River.*—In the original condition of the 9 miles of natural channel of this river from its mouth to the dam at the head of navigation at Watertown the depth at mean low water, from the mouth $4\frac{1}{2}$ miles to the Western Avenue Bridge, was not less than 7 feet, except in several places, covering about $1\frac{1}{2}$ miles. below Brookline bridge, where the depth varied from $4\frac{1}{2}$ to 7 feet. From Western Avenue Bridge $2\frac{1}{2}$ miles to the Arsenal Street Bridge the depth was 4 feet. Thence $1\frac{1}{2}$ miles to the dam it varied between 0 and $9\frac{1}{2}$ feet.

The original project, adopted by the act of June 14, 1880, which is also the existing project, is to widen and deepen the natural channel so that at mean low water it shall be from its mouth to Western Avenue Bridge 200 feet wide and not less than 7 feet deep; thence to Market

Street Bridge 80 feet wide and 6 feet deep; thence to the dam 60 feet wide and 2 feet deep; at an estimated cost of \$125,000.

The amount expended to June 30, 1903, is \$57,500, all for improvement, with which the channel has been completed as prescribed in the project up to the Arsenal Street Bridge (now called also Western Avenue Bridge).

The maximum draft that can be carried June 30, 1903, at mean low water over the shoalest part of the locality improved is 6 feet. The mean range of tides is 9.3 feet.

The head of navigation is at the dam at Watertown, the upper limit of that part of the channel under improvement, to which point, 9 miles above its confluence with Mystic River in Boston, the stream is navigable in fact.

A part of the channel remaining to be improved serves an annual commerce of approximately 20,500 tons of coal, enabling it to be delivered without breaking cargoes at Boston, saving the cost of one handling and the greater cost of transportation from Boston by rail. During the past fiscal year it was reduced by the coal strike about 50 per cent to about 10,000 tons.

The district officer is of opinion that so much of the existing project as provides for a channel from Brackett's wharf to Market Street Bridge, a distance of about 1,300 feet, and from Market Street Bridge to the dam at Watertown, is unworthy of prosecution by the General Government. This opinion is concurred in. The river and harbor act of September 19, 1890, appropriated \$20,000 for continuing improvement of Charles River:

Provided, That no expenditure, of said twenty thousand dollars shall be made until the draws in the Arsenal street and Market street bridges, shall be made to conform to the projected channel without cost to the United States.

The Arsenal Street Bridge has been altered to conform to the projected channel, and as the Market Street Bridge is above the limits to which it is now believed that the channel should be extended, it is recommended that Congress authorize the expenditure of the \$20,000 appropriated in 1890 in obtaining a channel of the projected width and depth to Brackett's wharf and in maintaining the Charles River improvement.

A full description of the project, together with map of the river showing the progress of the improvement to this date, is on page 512, Annual Report of the Chief of Engineers for 1884.

(b) *Fort Point channel*.—In its original condition the mid-channel depth was 12 feet at its mouth and 16 feet thence to the Federal Street Bridge, excepting at the draw in the Congress Street Bridge, where it was 14.5 feet at mean low water.

The original project, adopted by the act of August 5, 1886, which is also the existing project, is to dredge a channel 175 feet wide and 23 feet deep at mean low water from the entrance about 4,190 feet to near Federal Street Bridge, at an estimated cost of \$100,000.

To June 30, 1903, there has been expended \$18,027, all for improvement, with which a channel was obtained of the width and depth prescribed in the project from its entrance to the Congress Street Bridge, with an extension carried through the north draw to near the western extremity of the "rest pier."

The maximum draft that can be carried June 30, 1903, at mean low water over the shoalest part of the improved channel is 23 feet. The mean range of tides is 9.6 feet.

The head of navigation is the southern extremity of South Bay, at Massachusetts avenue, Boston, Mass., to which point, about 2 miles from the entrance to the channel in Boston Harbor, the channel is navigable in fact.

The commerce benefited by this improvement consists of coal, sugar, molasses, building materials, and miscellaneous merchandise, which amounted in the calendar year 1901 to 712,747 tons and in 1902 to 611,094 tons.

(c) *Chelsea Creek*.—In its original condition it had a channel of practicable width extending 11,000 feet from its confluence with Mystic River in Boston Harbor and 18 feet deep at mean high water, except on a bar about 2,000 feet below its head, upon which the depth was 17 feet. In the 3,300 feet from the head of the 18-foot channel to the head of navigation the depth gradually shoaled to 13 feet at mean high water.

The original project adopted by the act of June 3, 1896, which is also the existing project, is to make the channel about 5,500 feet in length next below the head of navigation, 150 feet wide, and 18 feet deep at mean high water, at an estimated cost of \$65,000.

The amount expended under this project to June 30, 1903, not including outstanding liabilities, is \$12,002.94, all for improvement, with which a channel has been dredged 75 feet wide and 18 feet deep at mean high water through a bar 2,000 feet below its head, and 50 to 150 feet wide, 14 feet deep at mean high water, and 2,800 feet in length from the head of the 18-foot channel to Proctor's wharf, 700 feet below the head of navigation.

The head of navigation is at the bridge of the Boston and Maine Railroad, to which point the stream is navigable in fact, 700 feet above Proctor's wharf.

June 30, 1903, the maximum draft that can be carried at mean high water over the shoalest part of the improved channel is 14 feet.

The mean range of tides is 9.6 feet.

The commerce benefited by this improvement consists chiefly of coal, of which 12,000 tons was carried in 1901 and 5,000 tons in 1902.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$143,935.64
June 30, 1903, amount expended during fiscal year	55,342.72
July 1, 1903, balance unexpended	88,592.92
July 1, 1903, outstanding liabilities	3,298.45
July 1, 1903, balance available	85,294.47
July 1, 1903, amount covered by uncompleted contracts	5,010.00
(Amount (estimated) required for completion of existing project	157,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	100,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

PROJECT OF 1892.

July 1, 1902, balance unexpended	\$440, 288. 21
June 30, 1903, amount expended during fiscal year	79, 391. 89
July 1, 1903, balance unexpended	360, 896. 32
July 1, 1903, outstanding liabilities	244. 10
July 1, 1903, balance available	360, 652. 22
July 1, 1903, amount covered by uncompleted contracts	184, 947. 84

PROJECT FOR BROAD SOUND CHANNEL.

July 1, 1902, balance unexpended	\$258, 904. 82
June 30, 1903, amount expended during fiscal year	102, 896. 38
July 1, 1903, balance unexpended	156, 008. 44
July 1, 1903, outstanding liabilities	21, 705. 35
July 1, 1903, balance available	134, 303. 09
July 1, 1903, amount covered by uncompleted contracts	1, 424. 78

PROJECT FOR 35-FOOT CHANNELS.

July 1, 1902, balance unexpended	\$600, 000. 00
Amount appropriated by sundry civil act approved March 3, 1903	150, 000. 00
June 30, 1903, amount expended during fiscal year	750, 000. 00
July 1, 1903, balance unexpended	11, 622. 32
July 1, 1903, balance unexpended	738, 377. 68
July 1, 1903, outstanding liabilities	6, 278. 78
July 1, 1903, balance available	732, 098. 90
July 1, 1903, amount covered by uncompleted contracts	2, 587, 143. 84

{ Amount (estimated) required for completion of existing project	7, 244, 248. 68
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	650, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897	

(See Appendix C 3.)

4. *Weymouth and Town rivers, Massachusetts.*—(a) *Weymouth River.*—

In its original condition at mean low water Weymouth River was navigable from its mouth in Nantasket Roads, Boston Harbor, 4 miles, to near its confluence with Town River, for vessels drawing 18 feet; 3,700 feet farther the depth at mean low water was 12 feet, and 4,000 feet farther it was 6 feet in a channel of practicable width; 7,000 feet farther the depth was 3 feet and the channel too narrow to be practicable.

Weymouth Back River had a practicable channel not less than 200 feet wide and not less than 12 feet deep at mean low water from its confluence with Weymouth River, 8,000 feet, to the wharf of the Bradley Fertilizer Company, except on its bar 400 feet across, one-fourth of a mile above its mouth, where the depth was 11 feet, and except the 2,000 feet next below the wharf of the fertilizer company, where the depth gradually shoaled from 12 feet to 6 feet at mean low water.

The original project, adopted by the act of September 19, 1890, which is also the existing project, is to obtain in Weymouth River a navigable channel 6 feet deep at mean low water for the further dis-

tance of 7,000 feet, 100 feet wide to near Weymouth Landing, 80 feet wide thence to Braintree bridge, and 50 feet wide above that point; and as extended by the act of August 18, 1894, to dredge in Weymouth Back River a channel 12 feet deep at mean low water 200 feet wide through the bar and to extend the channel 12 feet deep at mean low water and 200 feet wide, 2,200 feet to the wharf of the Bradley Fertilizer Company, at an estimated cost for Weymouth River of \$40,000, and for Weymouth Back River of \$22,000, a total of \$62,000.

The amount expended on this project to the close of the fiscal year ending June 30, 1903, is, for Weymouth River \$37,460.88, and for Weymouth Back River \$11,753.59; total, \$49,214.47, all for improvement.

This expenditure has resulted in deepening the channel in Weymouth River to 6 feet through the entire 7,000 feet of the river embraced in the project to the width of at least 100 feet for a distance of 3,325 feet from its lower end, 60 feet wide for a further distance of 1,650 feet, and of the full projected width for the further distance of 1,625 feet. In Weymouth Back River of the 2,400 feet of the channel embraced in the project, 400 feet on the bar has been dredged to the full width and depth prescribed in the project, and the 2,000 feet extending to the Bradley Fertilizer Company's wharf to the depth of 12 feet at mean low water and the width of 125 feet.

The maximum draft that can be carried, June 30, 1903, at mean low water over the shoalest part of the locality under improvement is, in the Weymouth River, 5 feet, and in the Weymouth Back River 10 feet. The mean range of tides is 9.4 feet.

The head of navigation is the dam at East Braintree, the upper limit of that part of the channel under improvement, to which point, 2.9 miles above its confluence with Town River, the stream is navigable in fact.

The annual commerce of Weymouth River comprised in 1901, in Weymouth Fore River 44,564 tons, and in Weymouth Back River 83,621 tons, amounting to 128,185 tons; and in 1902, in Weymouth Fore River 69,701 tons, and in Weymouth Back River 101,727 tons, amounting to 171,428 tons. In 1902, in Weymouth Fore River 64,216 tons, or 92 per cent, was coal, and in Weymouth Back River 96,788 tons, or 97 per cent, raw and manufactured fertilizer products.

A report of the survey of Weymouth Back River is in the Annual Report of the Chief of Engineers for 1891, page 683, and a map with description of the project was published as House Executive Document No. 256, Fifty-first Congress, second session.

Report of the survey of Weymouth Fore River authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

(b) *Town River.*—In its original condition Town River had a good channel not less than 7 feet deep at mean low water, extending 4,000 feet from its confluence with Weymouth River.

At that distance the channel suddenly shoaled to less than 4 feet, and was 1 to 2 feet deep for a distance of 3,300 feet, and was about 18 inches above low water for a further distance of about 1,200 feet to the upper wharves at Quincy.

The original project adopted by the river and harbor act of June 3, 1896, which is the present project, is to dredge the channel 4,500 feet long to the upper wharves at Quincy, to the width of 100 feet and depth of 4 feet at mean low water, at a cost estimated August 7, 1896, at \$25,000.

To June 30, 1903, the amount expended was \$17,864.35, all for improvement.

With this expenditure the lower 1,400 feet and the upper 1,000 feet of the channel 4,500 feet long have been dredged to the width of 50 feet, and the intermediate 2,100 feet to the full width of 100 feet and the depth of 4 feet at mean low water.

The maximum draft that can be carried on June 30, 1903, at mean low water over the shoalest part of the locality under improvement is 2.8 feet. The mean range of tides is 9.4 feet.

The head of navigation is at the upper limit of the improvement at Quincy, Mass., to which point, about 1½ miles above the confluence with the Weymouth River, the stream is navigable in fact.

The annual commerce of Town River amounted in 1901 to 97,000 tons, and in 1902 to 99,373 tons, of which 84 per cent was stone, and 11 per cent coal.

The original project, with map, was published as House Executive Document No. 155, Fifty-first Congress, second session. The report of survey, without map, is in the Annual Report, Chief of Engineers, for 1891, page 679.

July 1, 1902, balance unexpended.....	\$16, 168. 48
June 30, 1903, amount expended during fiscal year.....	247. 30

July 1, 1903, balance unexpended.....	15, 921. 18
---------------------------------------	-------------

Amount (estimated) required for completion of existing project.....	6, 750. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....	20, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C 4.)

5. *Harbor at Cohasset, Mass.*—In the original condition of this harbor the distance from the depth of 4 feet at mean low water in its roadstead was 4,600 feet through shoals of sand and mud to the depth of 4 feet at mean low water in a narrow channel extending with not less than that depth about 1,000 feet to the wharf. The least depth on the intervening shoal was 0.7 foot.

The original project adopted by the act of June 13, 1902, which is the present project, is to dredge a channel to the depth of 4 feet at mean low water from the roadstead to the wharf, 60 feet wide, increasing to 75 feet at the curve, and to dredge a turning basin in the harbor, 350 by 350 feet, at an estimated cost of \$21,670.

To the close of the fiscal year ending June 30, 1903, \$145.34, not including liabilities, has been expended, all for improvement.

The channel within the harbor for a length of 2,000 feet has been enlarged to the full width and depth required by the project.

The maximum draft that can be carried June 30, 1903, over the shoalest part of the locality under improvement is 0.7 foot at mean low water. The mean range of tides is 9.4 feet.

The commerce involved in this improvement was reported for the fiscal year 1902 to be the transportation into the harbor of about 2,000 tons of coal, 670 tons of lumber, and 500 tons of bricks, amounting to about 3,170 tons; and for the fiscal year 1903 to be 200 tons of coal and 400,000 feet of lumber, amounting in all to about 700 tons, the decrease in transportation of coal being due to the strike.

A description of the project, with map, was printed in House Document No. 284, Fifty-sixth Congress, first session, and, without map, in the Annual Report of the Chief of Engineers for 1900, page 1222.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, the Board of Engineers for Rivers and Harbors has considered the project for this work and has submitted a special report thereon, which will be found by reference to Appendix C 5. In view of all the facts presented in this report, it is recommended that the work of improving this harbor be discontinued and that no further appropriations be made.

July 1, 1902, balance unexpended	\$10,000.00
June 30, 1903, amount expended during fiscal year	145.34
July 1, 1903, balance unexpended	9,854.66
July 1, 1903, outstanding liabilities	3,762.68
July 1, 1903, balance available	6,091.98
July 1, 1903, amount covered by uncompleted contracts	5,388.58

(See Appendix C 5.)

6. *Harbor at Scituate, Mass.*—In its original condition the depth on the bar was about 2.5 feet at mean low water, and the entrance was obstructed by many sunken bowlders; of the low-water area of about 57 acres, 6 acres had a depth of at least 3 feet at mean low water and there was little protection against the sea.

The original project seems to have been to protect the beach between Cedar Point and the mainland on the northerly side of the entrance to the harbor, upon which, prior to operations under the existing projects (in 1829 to 1852), \$1,180 was expended in building 450 linear feet of brush and stone bulkhead and 385 linear feet of stone apron 10 feet wide.

The existing project, adopted by the act of June 14, 1880, is to build, of rubble stone, a north breakwater 800 feet and a south breakwater 730 feet long, to dredge an anchorage basin of 30 acres and an entrance channel 2,700 feet long and 300 feet wide, with depths at mean low water of 15 feet at the entrance, 12 to 15 feet between the breakwaters, 12 feet immediately back of the south breakwater, 10 feet in the anchorage basin, and 3 feet in the channel to the wharves, at an estimated cost of \$100,000 for the breakwaters and of \$190,000 for the dredging; total, \$290,000.

Up to the close of the fiscal year ending June 30, 1903, there had been expended on the work under the existing project \$103,351.94, of which \$1,989.11 was expended for maintenance in 1900 and 1901. The amount previously expended for maintenance is not ascertainable.

With that expenditure all known bowlders obstructing the entrance to the harbor have been removed; the anchorage basin, 350 feet by 400 feet, has been dredged 7 feet at mean low water, and the channel from the sea to the basin has been dredged 7 feet deep, 100 feet wide, and 1,600 feet long; the channel, 2,150 feet long from the anchorage basin to the town wharves, has been dredged 3 feet at mean low water at least 100 feet wide, and 720 linear feet of the north breakwater and 450 linear feet of the south breakwater have been built. The local officer has reported the locality to be unworthy of further improvement except for maintenance.

The maximum draft that can be carried at mean low water, June 30, 1903, over the shoalest part of the locality under improvement is

through the entrance channel and basin 7 feet and through the channel from the basin to the town wharves 20 inches at mean low water. The mean range of tides is 9.8 feet.

The commerce amounted in the fiscal year 1902 to 10,600 tons of coal and building materials, and in 1903 to 6,188 tons, of which 38 per cent is coal.

The existing project as reported by a Board of Engineers, September 18, 1880, with map of the harbor, is published in Annual Report of the Chief of Engineers for 1881, page 523.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, the Board of Engineers for Rivers and Harbors has considered the project for this work and has submitted a report thereon, which will be found by reference to Appendix C 6.

July 1, 1902, balance unexpended	\$148. 06
July 1, 1903, balance unexpended	148. 06

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	18, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix C 6.)

7. *Harbor at Duxbury, Mass.*—This harbor has two channels leading from deep water in the "Cow Yard" in Plymouth Harbor. The easterly channel to the east of Captains Hill is in Duxbury Bay, an extensive area of sandy shoals separated from the ocean by Duxbury Beach, a slender beach about $4\frac{1}{2}$ miles in length; the westerly channel, known as the Miles Channel, leads into Kingston Bay, west of Captains Hill.

In its original condition the easterly channel had a practicable width with a depth of 6 feet at mean low water to a point 2,600 feet from the wharf at Duxbury in Duxbury Bay, and the Miles Channel a depth of 8 feet at mean low water and a practicable width to a point 2,100 feet from the wharf at Duxbury in Kingston Bay.

The original projects appear to have been—

1. For the protection of the beach, authorized by the act of July 4, 1836, by building groins of stakes and brush.

2. For the improvement of the channel authorized by the act of June 10, 1872, to extend the Miles Channel by dredging to the depth of 8 feet and width of 200 feet for a distance of 2,300 feet from a point 200 feet above the wharf at Duxbury in Kingston Bay.

On these projects there was expended prior to operations under existing project \$25,000, with which some protection was given to Duxbury Beach, and the Miles Channel was extended the aforesaid distance with the aforesaid depth and width.

The existing project, approved by the Secretary of War August 12, 1899 (a modification of a project submitted November 28, 1887), is to dredge a channel 6 feet deep at mean low water 60 feet wide, increasing to 100 feet on the curve, from the southerly wharf at Duxbury in Duxbury Bay 3,600 feet to the head of the easterly channel, at an estimated cost (as increased in 1899) of \$17,820.

To the close of the fiscal year ending June 30, 1903, there has been expended under the existing project \$12,000, all for improvement. With this expenditure the easterly channel has been extended with the depth of 6 feet the entire distance of 3,600 feet to the wharf with a width of 80 feet at the wharf, 60 feet at the turn, and 40 feet elsewhere.

The maximum draft than can be carried over the shoalest part of the improvement at mean low water, June 30, 1903, is $4\frac{1}{2}$ feet. The mean range of tides is 9.3 feet.

The commerce amounted to 612 tons in 1900, to 1,480 tons in 1901, and 760 tons in 1902; in 1901, 968 tons, or 66 per cent, was coal.

The project for beach protection, adopted in 1836, is in the Annual Report of the Chief of Engineers for 1866, Part II, page 36.

The original project for improving the harbor is in Annual Report of the Chief of Engineers for 1872, pages 947 and 964.

The existing project (without modifications approved August 12, 1899) is in Annual Report of the Chief of Engineers for 1888, page 473, together with maps of the harbor. No map or description of the channel as modified under the project of 1899 has been published.

Amount (estimated) required for completion of existing project	\$5, 820. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905	4, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See appendix C 7.)

8. *Harbors at Plymouth and Provincetown, Mass.*—(a) *Harbor at Plymouth.*—In the original condition of the harbor the channel and low-water line were about 2,500 feet from the wharf at Plymouth. Long Beach, between the harbor and the ocean, was, for the most part, low and narrow, and liable to inroads by the sea that would injure or destroy the harbor.

All projects and expenditures prior to 1875 appear to have been for the construction of works for the preservation of the beach.

The original project for the improvement of the channel, adopted by the act of March 3, 1875, was to dredge a channel, 100 feet wide and 6 feet deep at mean low water, through the flats from the channel in the inner harbor to Long Wharf in Plymouth, at an estimated cost of \$28,000.

Prior to operations under the existing project \$190,634.38 had been expended in preserving Long Beach and in dredging under the project of March 3, 1875, as modified, which resulted in obtaining a channel 150 feet wide and 9 feet deep and a basin directly in front of the town wharves 866 feet long, 150 feet wide, and 9 feet deep. Of this amount \$60,727.52 was expended for maintenance.

The existing project for the protection of the beach, adopted by the act of March 3, 1899, is to strengthen the sections of beach damaged by the great storm of November, 1898, and to restore Eel River to its former course, discharging into the head of the harbor from its present course into the sea, to which it was changed by the storm. The estimated cost was \$95,700.

The amount expended on the work of the existing project to the close of the fiscal year ending June 30, 1903, is \$58,629.76, with which 10,468 linear feet of rubblestone dike was built on Long Beach, which has resulted in strengthening the beach by the accretion of a large volume of sand and beach shingle, and emergency contracts have been made for returning Eel River to its former course.

In addition to the aforesaid amount expended under the present project \$3,954.42 has been expended from the appropriation made by the act of June 13, 1902, for maintenance in redredging the turning basin which had been dredged at the wharves under the project of March 3, 1875.

The maximum draft that can be carried, June 30, 1903, at mean low water over the shoalest part of the locality under improvement is 9 feet. The mean range of tides is 10.1 feet.

The commerce of the harbor amounted, in the fiscal year 1902, to 32,873 tons, and in 1903 to 29,326 tons, of which about 93 per cent was coal.

The original project for dredging is published in the Annual Report of the Chief of Engineers for 1874, Part II, page 348. A map of the dredged channel and basin is printed in the Annual Report of the Chief of Engineers for 1888, page 460.

(b) *Harbor at Provincetown.*—This is an important harbor of refuge in the bight at the extremity of Cape Cod.

In its original condition the width and depth of its entrance and the depth of its anchorage were ample for the largest vessels, but actual or threatened inroads by the sea across the low and narrow part of the cape east of the town and at intervals along about $1\frac{1}{2}$ miles of the narrow beach southwest of the town were a serious menace to the harbor.

The original project, adopted by the act of May 19, 1826, was "for the preservation of the point of land forming Provincetown Harbor, Massachusetts."

The project from 1826 continuously to this date has been, by building dikes and groins and by other sand-catching devices, to arrest the erosion and promote the accretion of the barrier of beach and sand dunes which protects and preserves the harbor.

The amount expended to June 30, 1903, is \$162,019.86, all applied to improvement.

The result of the expenditure has been the preservation of the barrier of beach and sand dunes essential to the preservation of the harbor.

The maximum draft that can be carried, June 30, 1903, to the anchorage is ample for the largest vessels.

A description and plan of works are in the Annual Reports of the Chief of Engineers for 1876, 1879, and 1886, pages 181, 273, and 574, respectively.

A special project for the protection of the most slender part of the beach southwesterly of Provincetown is published, with map, in House Document No. 8, Fifty-fifth Congress, first session (see Annual Report of the Chief of Engineers for 1897, p. 878).

The commerce of this port, amounting in 1902 to about 24,000 tons, is a small factor in this improvement, compared with the preservation of this very excellent and important harbor of refuge.

July 1, 1902, balance unexpended	\$39,687.85
June 30, 1903, amount expended during fiscal year	6,240.93
July 1, 1903, balance unexpended	33,446.92
July 1, 1903, outstanding liabilities	1.25
July 1, 1903, balance available	33,445.67
July 1, 1903, amount covered by uncompleted contracts	3,276.21
{ Amount (estimated) required for completion of existing project	20,700.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	a 5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C 8.)

^a For Provincetown Harbor.

9. *Harbor at Chatham, Mass.*—In its original condition the tortuous channel $2\frac{1}{4}$ miles long from Chatham Roads to the wharves at Chatham had a ruling depth of not less than 7 feet at mean low water except on three bars, where the depth was 4 to $4\frac{1}{2}$ feet and whose total length was about 2,000 feet.

The original project, adopted by the act of September 19, 1890, was to dredge a channel 6 feet deep at mean low water 200 feet wide through the outer, 150 feet wide through the middle, and 100 feet wide through the inner bar, at an estimated cost (adopted by act of March 3, 1899) of \$13,732.79.

To June 30, 1903, there has been expended upon the improvement \$12,171.36, of which \$4,282.41 was for maintenance. With this expenditure channels have been obtained through the three bars of the full width and depth prescribed in the project.

The maximum draft that can be carried, June 30, 1903, at mean low water over the shoalest part of the locality under improvement is 6 feet. The mean range of tides is 5 feet.

The commerce of the harbor consists chiefly of coal and lumber, which, with general merchandise received and shipped at this port, amounts to about 6,000 tons annually.

A description of the harbor and of the project for its improvement is in the Annual Report of the Chief of Engineers for 1900, page 1217.

July 1, 1902, balance unexpended.....	\$1,561.43
June 30, 1903, amount expended during fiscal year (Dep. Cr. U. S. Treas.)..	1,561.43

(See Appendix C 9.)

10. *Removing sunken vessels or craft obstructing or endangering navigation.*—Wrecks of the schooners *Ira Laffrinier* and *Maud Briggs* were examined and were reported not to be dangerous obstructions to navigation in Nauset Harbor, Massachusetts.

The wreck of an old scow was found to be a dangerous obstruction to navigation in Boston Harbor, but it had drifted away and could not be found when a hoister was obtained to remove it.

The sum of \$129.52 was expended during the year.

(See Appendix C 10.)

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

This district was in the charge of Maj. Geo. W. Goethals, Corps of Engineers, until May 22, 1903, and of Capt. Cassius E. Gillette, Corps of Engineers, since that date. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. *Harbors at Hyannis and Nantucket, Mass.*—(a) *Harbor of refuge at Hyannis.*—The harbor of Hyannis lies on the south shore of the peninsula of Cape Cod and about 15 miles to the westward of the heel of the cape, and is an important harbor of refuge.

This harbor, before improvement, was an open roadstead exposed to southerly storms.

In the years 1827–1838 a breakwater 1,170 feet long was constructed of riprap granite, covering an anchorage of about 175 acres, the entrance to which has a depth of about 15.5 feet.

Between the years 1852 and 1882 extensive repairs were made, increasing the width of the base of the breakwater and the size of the stone forming its sides and top.

The sum of \$123,431.82 had been expended at this harbor prior to operations under existing project.

The existing project, approved in 1884, provides for dredging to 15.5 feet at low water about 36 acres area north of the existing breakwater, so as to increase the deep-water anchorage by that amount, all at a total cost estimated at that time at \$45,743.20, increased \$30,568.94 in accordance with report of December 2, 1899, by river and harbor act of June 13, 1902, making the total estimated cost \$76,312.14.

At the adoption of the existing project the 15.5-foot depth anchorage covered only about 47 acres, and the 36 additional acres to be dredged carried a depth of from 7 to 15.5 feet of water at low water.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, exclusive of outstanding liabilities, was \$43,842.31, none of which was applied to maintenance. Of the 36 acres, 26.6 has been deepened to 15.5 feet and two cuts 25 feet wide and 13 feet deep at mean low water have been made in the channel leading to the wharf of the New York, New Haven and Hartford Railroad Company.

The mean rise and fall of the tide is about 3 feet.

The principal value of this harbor to commerce is as a harbor of refuge for coasters and fishing vessels. The actual commerce of the place is, in general, agricultural products, coal, and fish, aggregating 22,680 tons. The increase of anchorage area will afford refuge for more and larger boats.

The unexpended balance will be applied to extending the 15.5-foot depth anchorage area by dredging. The additional work proposed is for the extension of benefits.

For map, see Annual Report of the Chief of Engineers for 1884, page 592.

A plan of the works may be found in the Annual Report of the Chief of Engineers for 1885, pages 560 and 621, and report of survey of 1899, in the Annual Report for 1900, page 1284; also published with map as House Document No. 79, Fifty-sixth Congress, first session.

(b) *Harbor of refuge at Nantucket, Mass.*—This harbor is the only one between the harbors of Marthas Vineyard (Vineyard Haven and Edgartown) and Provincetown, a distance of 100 miles, except the small harbor of Hyannis, on the north side of Nantucket Sound. It has considerable area, with a depth of water in excess of 12 feet, and the object of the improvement is to make it a harbor of refuge for vessels plying between ports north and south of Cape Cod. Incidentally, it forms a commercial harbor for the island of Nantucket, and it is the only one on the island. So far as known, it has never been used to any extent as a harbor of refuge.

In its original condition, the channel entrance was obstructed by a bar 1.5 miles in width, on which there was only 6 feet of water at low tide, the channel being very crooked and subject to changes in location. Between 1829 and 1844 an ineffectual attempt was made to dredge a channel through the bar; \$45,734.75 was expended prior to beginning operations under the existing project.

The present project, adopted in 1880 and modified in 1885, provides for the construction of two jetties, one on each side of the entrance,

and for dredging when necessary, in order to obtain a channel depth of from 12 to 15 feet at low water. Estimated cost, \$375,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, exclusive of outstanding liabilities, was \$260,730.13, of which \$7,210 was expended in repairs to the west jetty.

About 83 per cent of the west jetty and 53 per cent of the east jetty have been constructed. The least depth in the channel is 8 feet.

The mean rise and fall of the tide is about 3 feet.

During an unusually severe storm in December, 1896, a breach was made through the Haulover Beach between the ocean and the head of the harbor. The breach still remains open, but it does not appear to have affected the navigable depth of water in the entrance to the harbor.

A large portion of the 3,955 feet of the west jetty, built prior to 1884, has been damaged somewhat by storms and ice, and, having no core of small stone, allows considerable sand to pass through it. This should be repaired so as to be as sand tight as possible, and raised to its original height. It is estimated that \$30,000 will be required to complete the repairs, in addition to the estimated cost of the project.

Further work under the project will consist in raising the incomplete portions of both jetties, and extending the same with a view to the extension of the benefits to be derived from the improvement.

The entire commerce of Nantucket is carried on at this harbor, amounting in 1902 to about 28,290 tons. The effect of this work will be to afford a place of refuge easy of access and secure from storms for coasters and fishing vessels.

The original reports upon which the existing project was based and subsequently modified may be found in the Annual Reports of the Chief of Engineers for 1880, page 432, and for 1885, pages 563-578.

July 1, 1902, balance unexpended	\$36,861.11
June 30, 1903, amount expended during fiscal year	750.87
July 1, 1903, balance unexpended	36,110.24
July 1, 1903, outstanding liabilities.....	30.00
July 1, 1903, balance available	36,080.24
July 1, 1903, amount covered by uncompleted contracts.....	24,800.00
{ Amount (estimated) required for completion of existing project	112,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	85,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix D 1.)

2. *Harbor at Vineyard Haven, Massachusetts.*—Vineyard Haven is a deep indentation on the northern shore of the island of Martha's Vineyard, on the southern side of Vineyard Sound.

The headlands on either side of the entrance to the harbor were gradually wearing away, and the adjacent parts of the harbor were shoaling. The mean range of tide is 1.7 feet.

The existing project of 1887, as modified in 1889, provides for the protection of the "Chops" (or headlands) from erosion and the intervening harbor from being filled with the eroded material, the whole to be done by means of stone sea walls and jetties built along the beach

in front of the bluffs at both headlands. The total cost was estimated in 1889 at \$60,000, the whole of which has been appropriated.

The sum of \$55,387.35 had been expended on this work up to June 30, 1903, by which there had been built a series of riprap jetties and sea wall which appear to have afforded the needed protection. For details of construction, see Annual Report of Chief of Engineers for 1896, page 632.

The report upon which the protective works were based is printed in the Annual Report of the Chief of Engineers for 1882, at page 592, and further information, with maps, in Annual Report of Chief of Engineers for 1887, pages 572-580, and for 1893, page 812. The report of a preliminary examination of the harbor is printed as House Document No. 66, Fifty-sixth Congress, first session, and in Annual Report of the Chief of Engineers for 1900, page 1289.

The river and harbor act of June 13, 1902, provides that—

A Board of Engineers shall be appointed by the Secretary of War, who shall make * * * an examination of Vineyard and Nantucket sounds, and the east shore of Cape Cod, with a view to reporting upon the relative merits of each of said proposed localities for harbors of refuge. * * *

It is expected that the Board's report will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$4, 612. 65
July 1, 1903, balance unexpended	4, 612. 65

(See Appendix D 2.)

3. *Woods Hole channel, Massachusetts.*—Woods Hole is a waterway or strait connecting Buzzards Bay and Vineyard Sound and lying near the southwestern part of Cape Cod, Massachusetts. The name is also applied to the village in the near vicinity and to the Great Harbor and Little Harbor.

Before improvement the entrance to Little Harbor was obstructed by a bar with but 7.5 feet on it at mean low tide. Great Harbor has ample depth. In the strait the channels were crooked and obstructed by bowlders, and the velocity of the currents at certain stages of the tide was from 5 to 7 miles per hour. The site of the wharves and basins of the United States Fish Commission and Revenue-Marine Service was a submerged point of land from the shore of Great Harbor.

The original project of 1879 provided for making a channel through the bar at the entrance to Little Harbor and widening and deepening the channel through the strait. The project of 1883, extended in 1884 and 1886, provided for the construction of retaining walls on shore, a stone pier, and a wooden wharf, mainly for the use of the United States Fish Commission and incidentally for the use of the other branches of the public service, all of which work had been completed prior to 1889.

The amount expended on the original and modified projects prior to beginning operations on the existing project was \$113,599.92, by which the entrance to Little Harbor had been dredged to 10 feet depth, and a direct channel 9 feet deep had been dredged through the strait where none previously existed; the retaining walls, stone pier, and wooden wharves had also all been built and repaired. The existing project, that of 1895, provides for deepening the channel through the strait to 13 feet at mean low water, and widening the same to 300 feet; estimated cost, \$396,000.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1903, exclusive of outstanding liabilities, was \$41,942.08, resulting in the removal of all obstructing shoals to a depth of 13 feet at mean low water in the southern half of the channel.

There is now a channel of one-half the projected width (150 feet) and 13 feet depth through the strait, the western half of which is of the full width.

Further work will consist in extending the 13-foot depth of channel to the northward until the full-width is secured, and the dredging of the southern branch of the main channel.

The commerce of Woods Hole was about 19,266 tons for 1902, no account being kept of vessels passing through the strait.

For reports on original project, see Annual Report of the Chief of Engineers for 1875, page 272. For reports upon which existing project is based, see annual reports for 1893 and for 1895, pages 860 and 750, respectively.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	1,942.08
July 1, 1903, balance unexpended	18,057.92
July 1, 1903, outstanding liabilities	13,726.54
July 1, 1903, balance available	4,331.38
July 1, 1903, amount covered by uncompleted contracts	2,504.01
{ Amount (estimated) required for completion of existing project	336,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	70,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 3.)

4. *Harbor at New Bedford, Massachusetts.*—New Bedford is on an estuary of Buzzards Bay, and is the port of the cities of New Bedford and Fairhaven.

Before improvement the channel had a depth of 12.5 feet at mean low water. The improvement of this harbor has been carried on under a number of distinct projects, the first being the removal of a wreck and dredging the sand bar formed by it in 1836–1839, on which \$10,000 was expended. The projects of 1874 and 1877 provided for a channel 300 feet wide and 15 feet deep at mean low water from the deep water just above Palmers Island to the wharves of New Bedford. This work was completed in 1877 at a cost of \$20,000.

The project of 1887 provided for a channel 200 feet wide and 18 feet deep from Buzzards Bay to New Bedford, and was completed at a cost of \$35,000.

The project of 1899 provided for a channel 250 feet wide and 18 feet deep at mean low water from the anchorage basin, now under construction, through the new drawbridge between Fish and Popes islands to the deep water above, and was completed at a cost of \$34,000.

The existing project is that of 1895, and provides for dredging an anchorage area one-half mile long, 600 feet wide, and 18 feet deep at mean low tide on the north side of the channel leading from Fairhaven to New Bedford, at an estimated cost of \$57,689.33.

At the adoption of the existing project the anchorage area was from 12 to 18 feet deep.

The amount expended upon the project of 1895 up to June 30, 1903,

exclusive of outstanding liabilities, was \$28,944.22, by which 23 acres, or about 62 per cent of the anchorage basin, had been dredged.

Eighteen feet of water at mean low tide can now be carried from the main channel through the new drawbridge connecting Fish and Popes islands, but owing to the very soft nature of the material through which the channel was dredged, the full width of the 18-foot channel has not been maintained. In order that the projected width may be secured it is estimated that an expenditure of \$10,000 would be required for redredging the western portion of the channel.

The mean range of the tide is about 4.2 feet.

The commerce of the harbor amounted to about 468,408 tons in 1902. The effect of the deep water on commerce is the use of deeper draft vessels than formerly, larger cargoes, and a consequent reduction in water-freight charges.

For more extended information, see Annual Reports of the Chief of Engineers for 1875, Part II, page 283; 1888, page 514; 1893, page 816; 1896, page 672; 1897, page 930; 1900, page 1295; also House Executive Document No. 86, Fiftieth Congress, first session; House Documents Nos. 59, Fifty-fourth Congress, first session; 146, Fifty-fourth Congress, second session, and 169, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended.....	\$37,700.00
June 30, 1903, amount expended during fiscal year.....	8,935.22
July 1, 1903, balance unexpended.....	28,764.78
July 1, 1903, outstanding liabilities.....	879.92
July 1, 1903, balance available.....	27,884.86
July 1, 1903, amount covered by uncompleted contracts.....	25,485.44

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix D 4.)

5. *Taunton River, Massachusetts.*—This river rises in Norfolk County, Mass., and empties into Mount Hope Bay at Fall River.

In its original condition the channel was narrow and obstructed by bowlders, and from Berkley Bridge to Taunton the depth was in places not more than 5 feet at mean high water. A vessel of 30 tons burden was as large as could go up to Taunton. From 1870 to 1879 \$63,000 was appropriated to secure 9 feet depth at high water. This work was completed in 1879.

The approved project, adopted in 1880, provides for the widening and deepening of the river so as to secure a channel of at least 12 feet depth at high water, with 100 feet width from its mouth up to Berkley Bridge (above Dighton); thence 12 feet depth with 80 feet width (100 feet width at bends) up to Briggs Shoal; thence 11 feet depth with 80 feet width up to the "shipyard;" thence with 11 feet depth with 60 feet width up to Weir Bridge, Taunton; all at a total cost estimated in 1893 at \$125,000, all of which has been appropriated.

The sum of \$189,278.74 had been expended on this work up to June 30, 1903, by which expenditure all projected work had been practically completed and the shoals offering the greatest obstruction to the navigation of the river had been redredged. About \$20,278.74 of the above amount has been expended in the maintenance of the channel.

Vessels of 11 feet draft can reach Taunton at high water, but at some points the 11-foot channel is very narrow. It is estimated that \$5,000 every four years will be required to maintain the channel.

The tonnage of 1902 was about 587,600 tons.

For more extended information, see Annual Reports of the Chief of Engineers for 1880, page 375; 1884, page 606; 1893, page 824; also House Executive Document No. 86, Fiftieth Congress, first session.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	1,278.74
July 1, 1903, balance unexpended	3,721.26
July 1, 1903, outstanding liabilities	3,050.86
July 1, 1903, balance available	670.40
July 1, 1903, amount covered by uncompleted contracts.....	416.80
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
5,000.00	

(See Appendix D 5.)

6. *Sakonnet River, Rhode Island.*—Sakonnet River is an arm of the sea between the island of Rhode Island and the mainland, extending from the ocean to Mount Hope Bay around the head of Rhode Island. It is at present obstructed at its upper end by a causeway, known as the Stone Bridge, extending across it. This causeway has two openings, one covered by a draw which is of insufficient width and depth for the needs of commerce, and, besides, the causeway offers such obstruction to the ebb and flow of the tides that the currents through the openings make the passage dangerous even to boats of such dimensions as could pass through them under ordinary circumstances.

The present approved project provides for increasing the width and depth of the draw opening in the Stone Bridge, owned by the State of Rhode Island, so as to provide an opening 100 feet wide and 25 feet deep at mean low water, estimated to cost \$40,000.

No work has been done and no funds expended, owing to the fact that the proposed work involves the total destruction of the present bridge and the existing highway, while no provision is made for rebuilding the bridge or restoring the highway. Until the State of Rhode Island grants the Federal Government the unconditional right to proceed with the work authorized by Congress, and provides either for the restoration or discontinuance of the bridge and highway, the Secretary of War can not proceed with the work. The authorities of the State have been repeatedly advised of the existing complications and of the importance of having the legislature take the proper action to remove them.

The last session of the general assembly of the State adjourned without enacting such legislation as was desired by the War Department to enable it to commence this work.

The tonnage of the river for the year 1902 amounted to about 86,530 tons.

July 1, 1902, balance unexpended	\$40,000.00
July 1, 1903, balance unexpended	40,000.00

(See Appendix D 6.)

7. *Pawtucket River, Rhode Island.*—This river, otherwise called Seekonk River, is the upper portion of the Providence River, and extends from Pawtucket to Providence. Before improvement the channel in the river was narrow and had a ruling depth of about 5 feet at mean low water. Between 1867 and 1873 \$52,000 was appropriated to dredge the channel to 7 feet depth. This work was finished in 1876.

The existing project of 1883 provides for the deepening of the river so as to secure a channel of at least 12 feet depth at low water, with 100 feet width from its mouth, at Providence, up to opposite Grant & Co.'s wharf at Pawtucket, and thence 12 feet depth, with 40 feet width, through a ledge of rock for a short distance farther to Pawtucket bridge, all at a total cost estimated in 1883 at \$382,500, of which \$205,000 was appropriated prior to 1895.

The river and harbor act of March 3, 1899, provided for straightening that portion of the channel between Ten-Mile River and Bucklins Island; and the available balance, together with the further funds provided by Congress, will be applied to this work and to deepening the channel at points where it has shoaled.

The sum of \$307,519.59 had been expended on this work up to June 30, 1902. The amount expended on the work of the existing project up to June 30, 1903, exclusive of outstanding liabilities, was \$255,858.97, by which a channel had been secured 100 feet in width and 12 feet deep from the mouth of the river, near Providence, up to the lower wharves of the city of Pawtucket; thence a channel of 40 feet width and 12 feet depth had been completed through the ledge rock to the head of navigation, and the greater portion of the new channel between Ten-Mile River and Bucklins Island had been completed. A 12-foot channel is, however, available by the original route.

The mean rise and fall of the tide is about 5 feet.

The effect of the improvement is to cause the use of vessels of deeper draft than formerly, larger cargoes, and cheaper rates. The completed portion of the channel has already been a great benefit to the commerce of the river, which in 1902 amounted to a tonnage of 224,600.

The work yet to be done is to straighten and deepen the channel in its lower portions, and is an extension of the benefits secured.

For more extended information, see Annual Reports of the Chief of Engineers for 1884, page 608; 1893, page 830; 1895, page 677; 1900, page 1304; also House Document No. 113, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended	\$28,500.00
June 30, 1903, amount expended during fiscal year	339.38
July 1, 1903, balance unexpended	28,160.62
July 1, 1903, outstanding liabilities	254.48
July 1, 1903, balance available	27,906.14
July 1, 1903, amount covered by uncompleted contracts	24,745.52
(See Appendix D 7.)	

8. *Providence River and Harbor and Narragansett Bay, and removal of Green Jacket shoal, Rhode Island.*—(a) *Providence River and Harbor and Narragansett Bay.*—The object of this improvement is to furnish a wide and deep channel for foreign and coastwise commerce from the ocean to Providence.

Before the improvement of the river in 1853 many shoals obstructed

navigation, and at one point in the channel, a place called "The Crook," the available low-water depth was but 4.5 feet. Between 1852 and 1873 \$59,000 was appropriated to secure, first, 9 feet, and then 12 feet, depth of channel. This work was finished in 1873.

The approved project of 1878, as modified in 1882, provides for deepening the river and deepening and widening its anchorage basins so as to secure a channel of at least 25 feet depth at low water, with 300 feet width from the deep water of Narragansett Bay up to Providence, R. I., and so as to secure anchorage basins of 20 feet depth with 600 feet width, 18 feet depth with 725 feet width, 12 feet depth with 940 feet width, and 6 feet depth with 1,060 feet width from Fox Point to Fields Point, all at a total cost estimated in 1882 at \$675,000. This project was completed in 1895.

The total amount expended prior to operations under project of 1896 was \$698,490.60.

Another project originated in the river and harbor act of June 3, 1896, providing for securing a ship channel 400 feet in width and of a depth of 25 feet at mean low water from Sassafras Point in Providence Harbor, through Providence River and Narragansett Bay by the most direct route practicable to the ocean, by way of the "Western Passage," so-called, at an estimated cost of \$732,820. This project was put under the continuing-contract system, and was completed in September, 1902.

The amount expended on the work on the project of 1896 up to the close of the fiscal year ending June 30, 1903, exclusive of outstanding liabilities, was \$465,269.80, by which the channel 400 feet wide and 25 feet deep had been completed from Sassafras Point to the deep water of Narragansett Bay by the "Western Passage."

The existing project, approved by the river and harbor act of June 13, 1902, provides for an enlarged anchorage area of 25 feet depth, extending the full width of the harbor between Fox Point on the north and Long Bed and Sassafras Point on the south, including the area known as Green Jacket shoal.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, was \$9,927.23, by which the enlargement of the anchorage area in the upper harbor was well started. The available balance will be applied to enlarging the 25 foot-deep anchorage area in Providence Harbor.

The mean rise and fall of the tide is 4.7 feet.

The improvement in general has been of great benefit to commerce, which in 1902 amounted to about 2,379,000 tons. No special benefit is apparent from the dredging in the "Western Passage," the project for which originated in the river and harbor act of June 3, 1896. It cost about \$350,000, and shortened the channel a little for a part of the commerce of Providence.

For more extended information see Annual Reports of the Chief of Engineers for 1878, page 235; 1882, page 557; 1884, with plan of the works, page 622; 1893, page 830; and for historical data connected with the improvement, 1900, pages 1257 and 1308; also House Document No. 108, Fifty-sixth Congress, first session.

(b) *Removal of Green Jacket shoal.*—This shoal is in that part of Providence River which constitutes the harbor of Providence. It lies off the wharves on the south front of the city and occupies a part of the harbor that is required for anchorage purposes, covering an area of

about 18 acres between the 15-foot curves and about 30 acres in all. In its original condition the shoal in many places carried only 1 foot of water and was a very troublesome obstruction.

In the river and harbor act of June 13, 1902, provision is made for the removal of the remaining portions of this shoal in connection with the project for an enlarged anchorage area in Providence Harbor, and the work is now in progress under that project.

The sum of \$104,135.58 had been expended on this work up to June 30, 1902, by which 23.8 acres out of the original 30 of this shoal had been dredged to 25 feet depth, and a 16-foot depth had been secured over the central and largest portion of the shoal in addition to a 20-foot depth in the main channel, making an important addition to the anchorage facilities of Providence Harbor.

The mean rise and fall of the tide is about 4.7 feet.

The removal of the shoal will enable vessels to anchor outside of the channel, and thus remove an obstruction to vessels going to or from the Providence wharves.

For more extended information, see Annual Reports of the Chief of Engineers for 1885, page 598; 1893, pages 830-832; 1900, page 1308; also House Document No. 108, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended	\$207, 739. 95
June 30, 1903, amount expended during fiscal year	106, 620. 77
July 1, 1903, balance unexpended	101, 119. 18
July 1, 1903, outstanding liabilities	28, 945. 77
July 1, 1903, balance available	72, 173. 41
July 1, 1903, amount covered by uncompleted contracts.....	52, 371. 62
{ Amount (estimated) required for completion of existing project	507, 777. 50
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	125, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 8.)

9. *Harbor at Fall River, Mass.*—Fall River lies at the mouth of Taunton River, in the northeastern angle of Mount Hope Bay, which empties into the ocean through Narragansett Bay and Sakonnet River. It forms the port of entry of the city of Fall River, the largest cotton-manufacturing city in the United States.

Before improvement the depth of water in the reentrant in the wharf line north of the Old Colony Steamboat Company's wharf was only about 6 feet, and a considerable area of the harbor, especially in front of the upper wharves, carried much less depth of water than existed in its approaches.

The project of 1874 provided for deepening an area in front of the wharves immediately north of the Old Colony Steamboat Company's wharf 160 feet wide to 12 feet, and an additional width of 100 feet to 11 feet at mean low tide. This improvement was completed in 1878, at a cost of \$30,000.

The existing project, approved by the river and harbor act of March 3, 1899, and enlarged by the act of June 13, 1902, provides for a channel 300 feet wide and 25 feet deep at mean low water along the city front between the Old Colony wharf and deep water at the upper end of the city front; also for a channel of the same dimensions through Mount

Hope Bay to connect the deep water in front of the city with the deep water of Narragansett Bay, at a total estimated cost of \$175,411.94. Provision is made in this act for placing the work under the continuing-contract system.

The sum of \$37,551.09 had been expended on the existing project up to June 30, 1903, by which about three-fourths of the channel in front of the city and about one-tenth of the channel across Mount Hope Bay had been dredged.

The mean rise and fall of the tide is about 4.7 feet.

The work required to complete the existing project is dredging the upper portion of the new channel and dredging the channel across the flats in Mount Hope Bay to connect with the deep water of Narragansett Bay.

The commerce of the port in 1902 amounted to about 3,415,000 tons. The proposed improvement will give increased facilities for deeper-draft vessels.

For more extended information, see Annual Reports of the Chief of Engineers for 1874, Part II, page 284; 1895, page 272; 1897, page 931; also House Document No. 56, Fifty-fifth Congress, first session.

July 1, 1902, balance unexpended	\$38, 000. 00
Amount appropriated by sundry civil act approved March 3, 1903	117, 412. 00
	155, 412. 00
June 30, 1903, amount expended during fiscal year	17, 551. 09
July 1, 1903, balance unexpended	137, 860. 91
July 1, 1903, outstanding liabilities	22, 410. 91
July 1, 1903, balance available	115, 450. 00
July 1, 1903, amount covered by uncompleted contracts.....	101, 904. 08
(See Appendix D 9.)	

10. *Harbor at Newport, R. I.*—This harbor is at the main entrance to Narragansett Bay, and all the year it serves as an easily accessible harbor of refuge to foreign and coastwise commerce.

Before improvement the capacity of the inner harbor was limited by shoals, and it was not adequate to the number and size of the vessels seeking it for refuge. The southern or main entrance was obstructed by a bar which stretched out from Goat Island, and the northern entrance by a sharp rocky spit near Rose Island, and the general business wharves of the city could not be reached at low tide by vessels drawing more than 8 feet. The mean tidal range is about 3.75 feet. Between 1873 and 1875, \$28,500 was appropriated to secure 12 feet depth in the harbor. This work was completed in 1876.

The approved project, adopted in 1880 and modified in 1882, 1883, 1884, 1890, and 1895, provides for the widening and deepening of the channel from Narragansett Bay into Newport, so as to secure 15 feet depth at low water with at least 750 feet width; for the extension of the 13-foot depth and 10-foot depth anchorage basins, and for dredging a channel 10 feet deep along the State harbor line southward to opposite the gas company's wharf; for the partial cutting off of the shoal spit at the southern end of Goat Island, and for the construction of jetties on the western shore of Goat Island, so as to protect the end of this island from erosion and to prevent the drift of sand, etc., around the island into the adjacent parts of the harbor and channel,

and for the removal of Spindle Rock, a sharp, rocky spit near Rose Island; all at a total cost estimated in 1895 at \$206,200.

The sum of \$186,031.01 had been expended on this work up to June 30, 1903, by which the project had been practically completed.

No further work is required on the existing project after the completion of the contract now in force.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

As the improvement of this harbor has progressed there has been a large increase in the size and number of vessels using the harbor. The commerce for 1902 shows a tonnage of about 363,595 tons, principally fish, coal, and general merchandise.

For more extended information see Annual Reports of the Chief of Engineers for 1873, page 29; 1881, page 562; 1882, page 561; 1883, page 494; 1884, page 624; 1891, page 736, and 1892, page 627.

A plan of the works may be found in the Annual Reports of the Chief of Engineers for 1885, page 604, and for 1893, page 838.

July 1, 1902, balance unexpended	\$39, 750. 00
June 30, 1903, amount expended during fiscal year	^a 19, 392. 95
July 1, 1903, balance unexpended	20, 357. 05
July 1, 1903, outstanding liabilities	13, 202. 02
July 1, 1903, balance available	7, 155. 03
July 1, 1903, amount covered by uncompleted contracts	427. 42

(See Appendix D 10.)

11. *Harbor of refuge at Point Judith, Rhode Island.*—Point Judith is the southeastern extremity of South Kingston, R. I., and marks the southwestern entrance to Narragansett Bay. A long ledge, known as Squid ledge, extends for nearly a mile in a direction south by east, about 1.5 miles west of the point.

At the adoption of the project this place was a specially dangerous place for boats and tows to pass during storms and even ordinarily bad weather.

The existing project of 1889 provides for the construction at this point of a national harbor of refuge nearly a mile square, by means of stone breakwaters built partly on Squid ledge and planned so as to give protection against easterly, southerly, and westerly storms, the mainland itself forming a protection on the north, all at a total cost estimated in 1889 at \$1,250,000. This project was modified by the report of a Board of Engineers convened to consider and report upon the construction of this harbor, which was approved November 16, 1896, and provided for raising the crest of the eastern arm at an estimated cost of \$444,311. The river and harbor act of June 13, 1902, provides as follows: ¹

Improving Point Judith harbor of refuge, Rhode Island: Continuing improvement, one hundred thousand dollars, of which amount so much as may be necessary may, in the discretion of the Secretary of War, be expended in constructing the easterly detached breakwater and continuing it to the shore with a view of providing a shelter for a landing place. * * *

The estimated cost of the construction of the easterly detached breakwater submitted in the report of the Board of Engineers con-

^a Returned to Treasury United States \$408.33.

vened to consider the subject of harbors in this locality was \$196,193, and the estimated cost of constructing the extension to shore as given in the report of Maj. D. W. Lockwood, Corps of Engineers, dated April 14, 1897, was \$187,558.80. (Annual Report Chief of Engineers, 1897, Part I, 937.)

The sum of \$1,249,699.31 had been expended on this work up to June 30, 1903. By this expenditure the breakwater had been built to a total length of 6,970 feet, with a height of 10 feet above mean low water. It incloses an area of about 640 acres, of which 390 acres has over 25 feet of water and 198 acres over 18 feet. Three beacon lights had been established and maintained on the breakwater.

The construction of the extension to shore was under contract and the work had been started.

Four hundred and seventy vessels have anchored behind the breakwater during the past year, of which about 40 were schooners seeking shelter from storms. About 60 of the above 470 were catboats and small sloops coming in during heavy blows and gales. One steamer with three barges stopped during a southeast gale. One schooner dragged her anchor and went on the breakwater. The sheltered area has been principally used by small vessels going in and tying up over night.

A description of the works may be found in the Annual Report of the Chief of Engineers for 1890, page 595, and for 1893, page 840, and the report of the Board of Engineers in the Annual Report of the Chief of Engineers for 1897, page 920. Also see House Executive Document No. 66, Fifty-first Congress, first session.

It is expected that report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$103, 220. 62
June 30, 1903, amount expended during fiscal year	2, 881. 32
July 1, 1903, balance unexpended	100, 339. 30
July 1, 1903, outstanding liabilities	129. 82
July 1, 1903, balance available	100, 209. 48
July 1, 1903, amount covered by uncompleted contracts	90, 000. 00
{ Amount (estimated) required for completion of existing project	728, 062. 78
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	300, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 11.)

12. Entrance to Point Judith Pond, Rhode Island.—Point Judith Pond is a shallow salt pond, lying in the rear of the sandy beach of the Rhode Island shore, just west of Point Judith.

The improvement desired at this place by the people of the neighborhood is widening and deepening the present opening into the pond and the construction of jetties for the maintenance of such opening.

The present entrance to the pond is very shallow (less than 3 feet), crooked and variable in location and lies about a mile west of the former entrance.

The State of Rhode Island and the town of South Kingston are making an opening into the pond.

There is at present no approved project for the improvement of the pond entrance by the United States.

Up to June 30, 1902, \$518.38 had been expended in surveys.

For further information, see Annual Report of the Chief of Engineers for 1893, pages 841-879.

July 1, 1902, balance unexpended	\$9,481.62
June 30, 1903, amount expended during fiscal year	719.14

July 1, 1903, balance unexpended	8,762.48
--	----------

(See Appendix D 12.)

13. *Harbor of refuge at Block Island, Rhode Island.*—This island is about 14 miles east of the eastern end of Long Island, and about 10 miles distant from the nearest point of the mainland.

The object of the improvement is to furnish a harbor of refuge for medium-draft vessels engaged in foreign and coastwise commerce.

Before the construction of the present harbor Block Island had no harbor at all.

The mean tidal range is about 3 feet.

Between 1870 and 1876, \$285,000 was appropriated for a breakwater for a harbor for medium-draft vessels, this work being completed in 1878. Between 1880 and 1882, \$25,000 was appropriated for dredging an inner basin and the protection of the shore next to the breakwater, this work being completed in 1884. In 1884, \$15,000 was appropriated for additions to the old breakwater, this money being so spent and the work completed in 1884-85.

The project of 1884, as modified in 1888, provided for the construction of a harbor of refuge on the eastern side of the island, consisting of an enlarged inner harbor (or basin) 800 feet square for small vessels and an exterior harbor for larger ones, at a total cost estimated in 1888 at \$75,000. This project was practically completed in 1893.

The total expenditure prior to commencing work on the existing project was \$399,000.

The existing project, that of 1895, provides for raising the entire breakwater to proper height and stopping sand leaks between certain points, and dredging the main inner harbor to a depth of 10 feet, at an estimated cost of \$83,985.

At the adoption of the present project this harbor was neither large enough nor well enough protected for the proper harborage of the craft seeking refuge at this place during storms and bad weather.

The sum of \$23,380.36 had been expended on the existing project up to June 30, 1903, by which the entrance to the inner harbor, which had shoaled up from the drift of sand through the main breakwater, had been partially dredged to a depth of 12 feet and redredged to a depth of 10 feet several times. The north wall of the enlarged inner harbor had been strengthened and repaired, and the work of repairing the main breakwater and making it sand tight had commenced. About \$17,839.74 of the above amount had been expended in maintaining the channel at the entrance to the inner harbor, and repairing and strengthening the harbor walls.

During June, 1902, the sand shoal which closed the entrance to the inner harbor was dredged to 10 feet, the funds therefor, amounting to \$4,500, being allotted from the appropriation for "emergencies in river and harbor works." Of this allotment the sum of \$52.64 was expended during the fiscal year ending June 30, 1902.

The appropriation of June 13, 1902, will be applied to repairing the

main breakwater, making it sand tight in certain parts, and to dredging the inner harbor.

In 1902 the commerce amounted to about 75,025 tons, showing an increase over previous years.

For more extended information see Annual Reports of the Chief of Engineers for 1877, page 202; 1879, page 313; 1880, page 390; 1881, page 563; 1882, page 563; 1884, page 628. A plan of the works may be found in the Annual Reports of the Chief of Engineers for 1885, page 609; 1888, page 506; 1893, page 844; 1896, page 674; also in House Doc. No. 83, Fifty-fourth Congress, first session.

It is expected that report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$35, 209. 91
June 30, 1903, amount expended during fiscal year	a 8, 699. 10
July 1, 1903, balance unexpended	26, 510. 81
July 1, 1903, outstanding liabilities.....	2, 866. 62
July 1, 1903, balance available	23, 644. 19
July 1, 1903, amount covered by uncompleted contracts	18, 676. 30
{ Amount (estimated) required for completion of existing project.....	48, 985. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 13.)

14. Great Salt Pond, Block Island, Rhode Island.—The Great Salt Pond is located about the center of Block Island, and contains an anchorage area of 150 acres for vessels drawing 18 feet and over. The work of converting the pond into a harbor of refuge by making a channel through the beach on the west, connecting it with deep water in the ocean, was started by the State of Rhode Island and the town of New Shoreham.

The channel under the existing project of 1895, as modified in 1900, is to be 600 feet wide and have a central depth of 25 feet for a width of 150 feet, sloping gradually to 12 feet in a width of 504 feet, the channel seaward to be protected on the south by a jetty extending to 350 feet beyond the original 18-foot contour, and on the north by a jetty about 1,200 feet long, and the sides of the channel where it passed through the original beach to be protected by stone revetments and sand fences, at a total estimated cost of \$305,000.

At the time the work commenced under the general Government a channel of varying width and depth had been dredged with the money appropriated by the State and town, which would permit of 12-foot draft being carried in, although there were two 9-foot spots left in midchannel. The south jetty had been built out 837 feet, and a north jetty 250 feet long had also been built, but at a distance of 720 feet from the south jetty instead of 600 feet, as called for in the adopted project.

Up to June 30, 1903, \$95,072.68 had been expended by the general Government on the existing project, of which \$5,253.24 had been used for maintenance and repair. By this expenditure the south jetty had

been extended out to the original 18-foot contour and repaired, and an 18-foot channel, 300 feet wide, with a central cut 25 feet deep and about 35 feet wide, had been dredged.

Work on the extension of the south jetty is now in progress.

The channel dredged in 1900 to a depth of 18 feet, with a width of 300 feet, with a 25-foot-deep cut through the center, has shoaled to some extent. The sides of this channel now have about 15 feet of water, from which it deepens to 18 feet toward the center. The 25-foot cut has shoaled to 19 feet near the outer end.

There remains, to complete the existing project, the construction of jetties as planned and dredging to secure the widths and depths projected.

For more extended information, see Annual Reports of the Chief of Engineers for 1896, page 620; 1900, page 1276; also House Document No. 57, Fifty-fourth Congress, first session.

It is expected that report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$50,000.00
June 30, 1903, amount expended during fiscal year	5,072.68
July 1, 1903, balance unexpended	44,927.32
July 1, 1903, outstanding liabilities	11,575.76
July 1, 1903, balance available	33,351.56
July 1, 1903, amount covered by uncompleted contracts	25,037.79
{ Amount (estimated) required for completion of existing project	165,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix D 14.)

15. *Removing sunken vessels or craft obstructing or endangering navigation*—Steamer *Williamsport*, schooner *Thomas Borden*, barge *Wadena*, schooners *St. Thomas*, *James G. Blaine*, *Emily G. Sawyer*, *Sarah Potter*, *Marriot*, *Dora Matheys*, *Agnes E. Manson*, and the coal barge *Fidelia*.—Steamer *Williamsport* sunk 2 miles northwest of Pollock Rip light-ship, loaded with coal; removal completed in October, 1902. The schooner *Thomas Borden* burned in Hyannis Harbor, Massachusetts, April 10, 1902; removal completed in October, 1902. Barge *Wadena* was wrecked on Shovelful shoal off Monomoy Point and reported July 22, 1902; removal completed in October, 1902. Schooner *St. Thomas* was reported September 27, 1902, sunk 3 miles southeast of Cape Poge light-house; removal completed in January, 1903. The *James G. Blaine* was reported February 12, 1903, as wrecked southwest of Hardings Beach light, Massachusetts; removal completed in April, 1903. The *Emily G. Sawyer* was reported February 12, 1903, as wrecked off Monomoy Point, Massachusetts; removal completed in April, 1903. The *Sarah Potter* was reported April 1, 1903, sunk off Handkerchief shoal, Massachusetts; removal was nearly completed at the close of the fiscal year.

These wrecks were destroyed during the year, so as to form no obstructions to navigation, at a cost to the United States of \$6,878.60, not including cost of removing the *Sarah Potter*.

The removal of the following vessels, all reported June 9, 1903,

was authorized June 25, 1903, and work upon them will commence as soon as the wrecking party can be sent out: The schooner *Marriot*, reported as sunk about 10 miles west-southwest from the Vineyard Sound light-ship; the schooner *Dora Mathews*, sunk near Bass Rip, about 3 miles east of Sankaty Head, Nantucket Island; the schooner *Agnes E. Manson*, in the same locality; the coal barge *Fidelia*, 3 miles west of the Hen and Chickens light-ship, and directly in the path of vessels entering Buzzards Bay.

(See Appendix D 15.)

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT, AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

This district was in the charge of Maj. Chas. F. Powell, Corps of Engineers, having under his immediate orders Capt. C. H. McKinstry, Corps of Engineers, from July 8, 1902, to September 8, 1902; Lieut. W. D. Connor, Corps of Engineers, since October 8, 1902; and Lieut. William Kelly, Corps of Engineers, since April 25, 1903. Division Engineer, Col. Chas. R. Suter, Corps of Engineers.

1. Pawcatuck River, Rhode Island and Connecticut.—The navigable part of the Pawcatuck River extends 5 miles from the town of Westerly, R. I., to its outlet in Little Narragansett Bay, and thence through Little Narragansett Bay $2\frac{1}{2}$ miles to Stonington outer harbor, which forms the approach to the bay and river. Little Narragansett Bay is about $1\frac{1}{2}$ miles wide and $2\frac{1}{2}$ miles long. Its outlet into Stonington Harbor is about three-fifths of a mile wide. Pawcatuck River has a width of about one-third of a mile at its mouth and 200 feet at Westerly. Its average width is 1,000 feet.

Before improvement the channel of the river was crooked and obstructed by numerous shoals, on some of which there was but $1\frac{1}{2}$ feet at mean low water; $4\frac{1}{2}$ feet was the greatest depth that could be carried across the shoals of the bay. The mean tidal oscillation is 2.6 feet at the mouth of the river and 2.3 feet at Westerly.

The original projects, viz, that of 1871, for the river channel only, and that of 1876 for the channel across the bay, provided, respectively, for depths of $5\frac{1}{2}$ and 7 feet at mean low water and for widths of 75 and 200 feet. There was expended on original and modified projects prior to operations under existing project \$98,000.01.

The present project, approved July 24, 1896, and based on the report of the survey ordered in the river and harbor act of August 18, 1894, provides for a channel 10 feet deep from Stonington to Westerly, with a width of 200 feet from Stonington, Conn., to Avondale, R. I., a distance of about 4 miles; a width of 100 feet from Avondale to the lower wharves of Westerly, a distance of about 3 miles, and a width of 40 feet between the upper and lower wharves at Westerly, a distance of about one-half mile, at a total estimated cost of \$200,361.60. On this project \$36,457.78 has been expended to June 30, 1903, therewith completing the section 40 feet wide along the wharves at Westerly, extending the 100-foot channel downstream 1,800 feet farther, and making a part channel through Little Narragansett Bay. Of this amount \$6,546.18 was applied to maintenance. The maximum draft which could be carried June 30, 1903, at mean low water over the shoalest part of the channels under improvement, was 8 feet. The principal articles of commerce benefited by the improvement are coal and lumber.

Comparative tonnage.

Year.	Tons.	Year.	Tons.
1896.....	39,086	1900.....	57,580
1897.....	46,024	1901.....	48,313
1898.....	181,602	1902.....	116,399
1899.....	66,742		

The additional work proposed is necessary for retaining the present improvement and extending its benefits.

July 1, 1902, balance unexpended	\$9,088. 40
June 30, 1903, amount expended during fiscal year	6,546. 18

July 1, 1903, balance unexpended	2,542. 22
July 1, 1903, outstanding liabilities	. 10

July 1, 1903, balance available	2,542. 12
---------------------------------------	-----------

{ Amount (estimated) required for completion of existing project	161,361. 60
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	9,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 1.)

2. *New London Harbor, Connecticut.*—New London Harbor comprises the lower 3 miles of the Thames River, having a navigable width of one-quarter to 1½ miles and depths of 26 feet or more in the main channel from Long Island Sound to the railroad drawbridge which crosses the river above the New London dock front. This channel, especially opposite New London, follows the east bank. Between it and the city docks is a nearly level area having an average depth of 10 to 15 feet. Heretofore vessels of 16 to 18 feet draft have been able at high tide to reach some of the docks. Under a modification of the existing Thames River project, adopted in 1872, Shaws Cove, a branch of New London Harbor, has been dredged to 12 feet.

The project of improvement of New London Harbor, adopted by the act of June 13, 1902, being the first one adopted for this harbor distinct from Thames River improvement, provides for a ship channel 400 feet or more in width, 23 feet deep, and about 6,000 feet long. It is to leave the deep water of the river opposite Fort Trumbull on the west side, skirt the water front of the city, including that of Winthrop Cove, to the Central Vermont Railroad Bridge, and join the natural deep channel off the end of the Central Vermont Railroad dock, or at a distance of about 4,000 feet upstream from the point of beginning. The estimated cost of the improvement is \$145,000, and \$1,000 per annum for maintenance. The tidal oscillation is 2.6 feet. For map, see House Document No. 392, Fifty-sixth Congress, first session.

The appropriation item authorizes a continuing contract for completion of the work and an examination of the part of Winthrop Cove named, with a view of securing a depth of 30 feet on the lines of the survey on which the authorized improvement project is based. On this project \$1,269.71 has been expended up to June 30, 1903.

It is expected that report of the examination of Winthrop Cove, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

The tonnage of this port, exclusive of that pertaining to Thames River above New London Harbor, was reported for 1901 as 750,390, and for 1902 as 893,755.

The principal articles of commerce to be benefited by the improvement are coal, lumber, building material, oil, and steamboat freight. The maximum draft which could be carried June 30, 1903, over the shoalest part of the channels under improvement was about 11 feet at mean low water, or along the more important portion, 15 feet.

The improvement in progress under a continuing contract is for extension of benefit to commerce.

July 1, 1902, balance unexpended	\$25,000.00
Amount appropriated by sundry civil act approved March 3, 1903	60,000.00
	85,000.00
June 30, 1903, amount expended during fiscal year.....	1,289.71
July 1, 1903, balance unexpended	83,730.29
July 1, 1903, outstanding liabilities	1,029.83
July 1, 1903, balance available	82,700.46
July 1, 1903, amount covered by uncompleted contracts	137,739.09
{ Amount (estimated) required for completion of existing project.....	60,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905,	
in addition to the balance available July 1, 1903.....	60,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

(See Appendix E 2.)

3. *Thames River, Connecticut.*—This river is a tidal stream from Norwich, Conn., the head of navigation, to Long Island Sound, a distance of 15 miles. For 4 miles below Norwich the natural depths were 6 feet or more at low water and width of 400 to 1,000 feet. Below this point depths were 13 feet or more and widths 800 to 3,000 feet.

In 1836 the original project was adopted, providing for a channel 11 feet deep at low water, to be secured by dredging and building dikes. On this project \$40,300 had been expended when, in 1839, work was stopped, the project not having been completed.

The existing project, adopted June 23, 1866, and modified in 1876, 1882, 1888, and 1892, is to dredge and build training walls to secure a channel 200 feet wide with depths of 16 feet from New London to Allyn Point and 14 feet thence to Norwich; also to dredge Shaws Cove to the harbor lines on all sides a depth of 12 feet at mean low water. Estimates of cost were \$457,620 for construction and \$8,000 annually for maintenance.

Up to June 30, 1903, there had been expended \$412,578.35 on this project and its modifications, of which \$6,288.74 was applied to maintenance. Three of the five proposed training walls had been completed and the fourth nearly so. The proposed 16-foot channel had been completed to Allyn Point, thence to Norwich the project depth of 14 feet had been secured in a channel varying in width from 100 to 175 feet, which has since become narrower by shoaling. The proposed dredging in Shaws Cove had been completed; it has now shoaled to about 9 feet in front of the principal docks. Tidal oscillation averages 2.6 feet at New London and 3.1 feet at Norwich.

Commerce at Norwich and Allyn Point is mainly in coal, lumber and other building materials, iron, and miscellaneous goods. The

work done has reduced the cost of transportation by enabling freight to be brought in vessels of 16 and 18 feet draft instead of 8 feet. The river commerce of the present day could not be carried except for the increased depth thus obtained, and urgent requests have been received for a further increase in channel depths to accommodate the deeper-draft vessels now going to Allyn Point.

Comparative tonnage.

Year.	Tons.	Year.	Tons.
1893.....	546,900	1900.....	464,283
1896.....	424,945	1902.....	355,074
1898.....	459,588		

The additional work proposed is necessary for retaining the present improvement and extending its benefits.

July 1, 1902, balance unexpended	\$15,074.32
June 30, 1903, amount expended during fiscal year	4,152.67
July 1, 1903, balance unexpended	10,921.65
July 1, 1903, outstanding liabilities	55.00
July 1, 1903, balance available	10,866.65
{ Amount (estimated) required for completion of existing project	34,100.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	18,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 3.)

4. *Connecticut River below Hartford, Conn.*—Before the beginning of improvements by the United States the available depth over Saybrook bar, at the mouth of the river, was 7 feet at mean low water; thence to Hartford the available depth over the shoalest of the river bars was about 5 feet at low water, being generally at its minimum after the spring freshets, and increasing as the period of summer low water continued.

In 1873 a project was adopted for improving the channel at Saybrook bar by dredging and by building three jetties, at an estimated cost of \$336,610. Two of the proposed jetties were completed in 1881 and the third was found to be unnecessary. The amount expended on the project was \$23,471.57.

The present project, adopted in 1870 and modified in 1887, provides for a channel from Long Island Sound to Hartford, Conn., to be 400 feet wide and 12 feet deep at mean low water across Saybrook bar, and thence to Hartford 100 feet wide (or as nearly that as practicable) and 9 feet deep at extreme low water, or about 10 feet at ordinary summer low tide, the channels to be maintained by annual dredging in the river and by enlarging the Saybrook jetties and the Hartford dike at an estimated cost—

For annual dredging.....	\$10,000
For permanent work, which includes the dredging at Saybrook bar (estimated in 1889).....	130,000

The act of June 13, 1902, authorized an expenditure of \$1,000 for removal of obstructions at mouth of Salmon River, a tributary to the Connecticut River.

The total amount expended on this project to close of fiscal year ending June 30, 1903, is \$489,045.88, of which about \$261,947.03 has been applied to maintenance.

The maintenance of navigable channels by annual dredging has been held paramount in the project, the available funds at no time having been sufficient for enlarging the dike or Saybrook jetties or for additional dredging at Saybrook bar. Annual dredging as private work has been done. The maximum draft which could be carried at mean low water over the shoalest part of the river under improvement on June 30, 1903, was 7 feet. The rise of tide is 3.6 feet at Saybrook jetties and 0.8 foot at Hartford.

It is expected that report of the examination of Connecticut River between Hartford, Conn., and Holyoke, Mass., authorized by the river and harbor act, approved June 13, 1902, will be submitted to Congress in December, 1903.

Sketches of the Connecticut River from Hartford to Rocky Hill and of Saybrook bar are printed in the Annual Report of the Chief of Engineers for 1885, page 636. The river from the Sound to Hartford is shown on Coast Survey charts 253, 254, 255, and 256.

Commerce is mainly in coal, lumber, stone (shipped from Portland and vicinity), building materials, and miscellaneous steamboat and barge freight.

The work done and being done has reduced freights on these articles materially, and without the improvements there could be little commerce on the river.

Comparative tonnage.

Year.	Tons.	Year.	Tons.
1890.....	1,095,000	1900.....	700,000
1894.....	560,000	1901.....	723,187
1898.....	665,000	1902.....	570,818

July 1, 1902, balance unexpended	\$30,075.45
June 30, 1903, amount expended during fiscal year	14,422.90

July 1, 1903, balance unexpended	15,652.55
July 1, 1903, outstanding liabilities	2,079.09

July 1, 1903, balance available	13,573.46
---------------------------------------	-----------

July 1, 1903, amount covered by uncompleted contracts.....	6,612.26
--	----------

(Amount (estimated) required for completion of existing project	100,000.00
---	------------

Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	30,000.00
---	-----------

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
--	--

(See Appendix E 4.)

5. *Harbor of refuge at Duck Island Harbor, Connecticut.*—Duck Island Harbor is a bay on the north shore of Long Island Sound. It is about 7 miles west of the mouth of the Connecticut River and midway between the harbors of New Haven and New London. The mean tidal oscillation is 3.8 feet.

The project for this improvement, adopted by the river and harbor act of 1890, provides for the construction of three riprap breakwaters

of 3,000, 1,750, and 1,130 feet length, respectively, inclosing and sheltering an area of about 115 acres, with two ample entrances. The adopted height is 6 feet above high water, with crown of 10 feet and slopes of 2 on 3 outside and 1 on 1 inside. The estimated aggregate cost is \$463,540. (For map see Annual Report of the Chief of Engineers for 1887, p. 644.)

To June 30, 1903, \$114,158.61 had been expended, \$202 of which was for maintenance; 2,770 linear feet of the west breakwater had been built, extending westwardly from Duck Island to a low-water depth of 17 feet. No work in furtherance of the project was done during the past year from lack of funds. Future appropriations will be applied to the construction of the breakwater eastward from Duck Island and in retopping the portion of the west breakwater built in 1898.

The commerce to be benefited by this improvement is the passing commerce of Long Island Sound, which may find it convenient or necessary to seek shelter behind the breakwater during storms. Its value can not be estimated with any accuracy. During the year 1900, 1,707 vessels were reported as seeking Duck Island Harbor for refuge.

July 1, 1902, balance unexpended	\$43. 39
July 1, 1903, balance unexpended	43. 39

(Amount (estimated) required for completion of existing project	349, 540. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	40, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 5.)

6. *Branford Harbor, Connecticut.*—This harbor consists of the lower part of a small tidal stream, about $1\frac{1}{4}$ miles long from the head of navigation, emptying into a bay about $1\frac{1}{4}$ miles long and 1 mile wide, on the north shore of Long Island Sound a short distance east of New Haven. The natural depth of water across the mouth of the bay is about 16 feet at mean low water, shoaling gradually to $8\frac{1}{4}$ feet between two rocks known as "The Mermaids," near the middle of the bay, and thence to the mouth of the river it is very uniform at $8\frac{1}{4}$ feet. The channel through the river to the lower coal dock varies from $8\frac{1}{4}$ to 12 feet or more. From the lower to the upper docks it gradually narrows and shoals so that the controlling depth is somewhat less than 6 feet, and the width from 25 to 50 feet, at mean low water. The mean rise of tide is 6 feet.

The original and present project authorized by the act of June 13, 1902, which provides for its completion in accordance with report published in House Document No. 100, Fifty-sixth Congress, second session, and in Annual Report of 1901, page 1189 et seq., is to dredge and maintain a channel 100 feet wide and $8\frac{1}{4}$ feet deep at mean low water in the upper part of the river between the lower and upper docks, at a cost of \$5,000 and \$250 annually for maintenance.

No work of improvement was conducted during the year. A complete survey of the harbor was made. Proposals were invited for dredging the above-described channel, but no bids were received at a price low enough to allow of the completion of the project. The yardage of the work is nearly 40,000; the best contract price obtainable was 25 cents per cubic yard. The work can not be completed for the amount appropriated.

The amount expended on this project to June 30, 1903, is \$202.01.

The commerce of this harbor is mainly coal, iron, molding sand, and clay. Traffic for calendar year 1902 amounted to 25,436 tons, a decrease of 8,684 tons from that of 1900, the previous report received.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	202.01

July 1, 1903, balance unexpended	4,797.99
--	----------

(See Appendix E 6.)

7. *New Haven Harbor, Connecticut.*—This is a bay on the north shore of Long Island Sound extending about 4 miles inland, and from 1 to 2 miles wide. Mill and Quinnipiac rivers, navigable for about 1 and 3 miles, respectively, above their mouths, empty into the head of the harbor from the northeast. The original available low-water depth from the wharves to Cranes bar, one-third way down the harbor, was 9 feet; thence to Fort Hale, halfway down, it was 16 feet or over; next below Fort Hale was a broad bar of soft mud extending across the channel, with available depth of 13 feet. The harbor entrance was partly obstructed by several sunken rocks. In Quinnipiac River the available low-water depth was about 4 feet, and in the west branch of Mill River about 5 feet to the head of the present projected improvement. Above this point both rivers are for the most part only available for navigation at high tide. The entire east branch of Mill River runs nearly bare at low tide.

In 1870 a project was adopted for removal of sunken rocks at the harbor entrance. This work was not continued after 1875, when the harbor breakwaters were first proposed. In 1871 the project was extended to include deepening the harbor channel, the proposed depth and width being modified from time to time as appropriations were made, so that when the present project was adopted, March 3, 1899, it consisted in making a channel 16 feet deep and from 400 to 700 feet wide from Long Island Sound to the head of the harbor, and in constructing a dike to contract the channel width across Fort Hale bar, at a total estimated cost from beginning of \$348,000. This project was nearly completed, the deficiencies being in the length of channel arm of the dike which was about two-thirds the projected length, and in widening the channel across Fort Hale bar, which was only 200 feet wide. The total amount expended on previous projects was \$325,695.66.

The present project, act of March 3, 1899, is to dredge a channel 20 feet deep, 400 feet wide, and 4 miles long from Long Island Sound to Canal dock; thence one-half mile to Tomlinson Bridge, of same depth and 300 feet wide; and three anchorage basins of 20, 16, and 12 feet depths, respectively, estimated to require the removal of 3,287,000 yards, at a cost not to exceed \$345,000, and, act of June 13, 1902, to extend the improvement to the Quinnipiac and Mill rivers to Grand avenue, provided the cost did not exceed the total amount authorized in act of March 3, 1899. The project for the latter-named works, as approved January 27, 1903, is: A channel 12 feet deep and 200 feet wide in Quinnipiac River to Ferry Street Bridge; a channel 8 feet deep and 50 feet wide in Quinnipiac River through the shoals at the ends of the natural channel between Ferry Street and Grand Avenue bridges, and a channel 12 feet deep and 200 feet wide in Mill River to the junction of the two branches above Chapel street and thence 12 feet deep and 75 feet wide up each branch to Grand avenue.

At the beginning of the last fiscal year a continuing contract for dredging was in force for completion of the project below Tomlinson Bridge at the base price of 6 cents per cubic yard. Work under this contract was completed on March 20, 1903, an aggregate of 3,265,832 yards having been removed, of which 1,130,763 was removed during the past fiscal year. On May 2, 1903, a contract was entered into for the completion of the project above Tomlinson Bridge, and on May 26 contract work was begun. At the close of the year, 32,893 yards had been removed from the lower portion of Mill River.

The amount expended on the existing project up to close of the fiscal year ending June 30, 1903, was \$213,333.31.

The completion of the project below Tomlinson Bridge has been of great benefit to commerce of this port, as it enables deep-draft vessels to proceed directly to their docks without waiting for a chance to obtain a berth at their docks or for light vessels bound out. Previously these vessels were obliged to anchor in or close to the channel, which was thereby greatly obstructed. The maximum draft which can now be carried through the main channel to the head of the harbor is 20 feet at mean low water. A considerable number of vessels drawing from 22 to 23 feet entered the harbor during the past year. The maximum low-water draft which can be carried up Quinnipiac River to Ferry Street Bridge is about 10 feet, and from Ferry Street Bridge to Grand Avenue Bridge about 4 feet; up Mill River to Grand Avenue Bridge, about 5 feet in the west branch and about 1 foot or less in the east branch. The mean rise of tide is 5.7 feet at the entrance to the harbor and 6.2 feet above Tomlinson Bridge.

The commerce of New Haven Harbor is mainly in coal, iron, lumber, oysters, and miscellaneous merchandise. The tonnage for the calendar year, 1902, was 2,086,990, which is a decrease of 1,650,059 tons over that reported for 1901. A large proportion of this decrease is accounted for by a diminished amount of coal received.

For maps and further details regarding the harbor and previous projects, see Annual Report for 1899, page 678; 1896, page 702; 1895, page 777; House Document No. 82, Fifty-fifth Congress, first session.

The engineer officer in charge invites attention to the commercial need of greater capacity of channel in the Quinnipiac River from Tomlinson Bridge to Ferry Street Bridge than that authorized by Congress.

Report of the examination of channel from New Haven Harbor via Oyster Point to Kimberly Avenue Bridge on West River, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$102, 475. 37
Amount appropriated by sundry civil act approved March 3, 1903	63, 073. 90
	165, 549. 27
June 30, 1903, amount expended during fiscal year	98, 504. 34
July 1, 1903, balance unexpended	67, 044. 93
July 1, 1903, outstanding liabilities	4, 682. 86
July 1, 1903, balance available	62, 362. 07
July 1, 1903, amount covered by uncompleted contracts	46, 756. 05
(See Appendix E 7.)	

8. *Breakwaters at New Haven, Conn.*—The existing and original project for this work, adopted in 1879 and modified in 1890, is to make a harbor of refuge at the entrance to New Haven Harbor by constructing four breakwaters—one extending from Southwest ledge to Quixes ledge; one 5,000 feet long, extending from a point 1,000 feet north, 54° east from Ludington rock southwesterly across the rock; one about 4,200 feet long, extending northwesterly from a point 6,000 feet south, 54° west from Ludington rock, and one about 1,200 feet long, extending southwesterly from Morgan Point, on the east side of the harbor entrance. The estimated cost of the whole work from the beginning, in 1879, was \$2,151,134.

The anchorage outside of the bar which will be sheltered by this breakwater exceeds 2,000 acres, and has depths of 9 to 26 feet at mean low water.

A sketch of New Haven Harbor, showing the location of the breakwaters as contemplated under the existing project is printed in the Annual Report of the Chief of Engineers for 1889, page 678, and the last printed sketch may be found in Annual Report for 1896, page 702.

Up to June 30, 1902, the breakwater from Southwest ledge to Quixes ledge had been completed, the Ludington rock breakwater had been made 4,500 feet long, and 1,490 feet of the west breakwater had been built. The total expenditure to June 30, 1903, was \$835,487.31.

The work of a short extension to the west breakwater is in progress under contract.

The commerce now benefited and to be further benefited by this work is mainly the passing commerce of Long Island Sound. The projected breakwaters provide an outer anchorage for vessels bound to and from New Haven and help protect the entrance to New Haven Harbor proper from seas and to diminish channel filling. For nine months of calendar year 1901, 32,283 vessels were reported as passing the breakwaters, the number passing during dark nights or fogs not being observed. The number of round trips of vessels at New Haven for calendar year 1901 was 30,110. The additional work proposed is for extension of benefit to commerce. The mean rise of tide is 5.7 feet.

The project could be readily completed within four years.

July 1, 1902, balance unexpended	\$44,565.39
June 30, 1903, amount expended during fiscal year	1,052.70
July 1, 1903, balance unexpended	43,512.69
July 1, 1903, outstanding liabilities	35.57
July 1, 1903, balance available	43,477.12
{ Amount (estimated) required for completion of existing project	1,272,134.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	150,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E 8.)

9. *Milford Harbor, Connecticut.*—This harbor is on the north shore of Long Island Sound, and consists of a broad open bay from the head of which a small tidal stream extends nearly a mile inland to the head of navigation.

The original depth on the bar outside the mouth of the river was

less than 2 feet at low tide, and in parts of the river the channel ran nearly bare. The mean rise of tide is about 6.2 feet. The original project, adopted in 1872 and modified in 1877 and 1879, provided for a channel 100 feet wide and 4 feet deep at the outer bar; through the river of the same depth, and 60 feet wide from Merwin's wharf to the Town dock, and thence 40 feet wide to the Straw Works wharf at the head of the harbor; for a series of spur dikes to protect Welch's Point on the east shore from erosion, and for two jetties to maintain the bar channel, one projecting from the east shore near the mouth of the river and the other off Burns Point nearly at right angles to the first. This project was completed in 1880. A revised project, adopted in 1881, provided for an increase in the depth of the bar channel of from 4 to 8 feet. In 1891 this project was reported as completed, with the jetties and bar channel in good condition and the channel in the upper harbor somewhat deteriorated. No work has since been done by the United States. In 1894 and 1895 permits were granted private parties to dredge in this vicinity for material to be used in oyster culture, conditioned upon the work being done under the supervision of the local engineer and directed to the betterment of navigation. Under these permits a large quantity of material, possibly 85,000 yards, was removed. It was taken almost wholly from the bar channel, and it was stated that when the work was completed in July, 1895, there was a clear channel across the bar 12 feet deep at mean low water, and nowhere less than 80 feet wide. On these previously adopted projects \$45,500, and for surveys \$1,600, were expended.

The existing project authorized by act of June 13, 1902, for completion at a cost of \$15,000, consists in dredging and maintaining a channel across the bar and through the lower harbor 100 feet wide and 10 feet deep to Merwin's wharf, with an anchorage basin of same depth, of about six acres area, on the east side of the channel between the long dike and the harbor line, and a channel through the upper harbor from Merwin's wharf to the Straw Works wharf 90 feet wide and 6 feet deep. The estimated cost for maintenance was \$1,000 biennially. The amount expended on this project to June 30, 1903, is \$266.89.

No work of improvement was conducted during the year.

The improvement can not be completed for the amount appropriated.

At present a low-water draft of from 8 to 8½ feet can be carried over the bar and up as far as Merwin's wharf. Above this point a draft of about 4 feet can be carried as far as the town wharf and about 3 feet to the Straw Works dock at the head of the harbor.

The commerce of this harbor consists almost entirely of oysters and coal, the former predominating. Traffic for calendar year 1902 amounted to 14,534 tons, an increase of 2,769 tons over that last reported in 1899. For further details regarding this harbor, see House Document No. 280, Fifty-sixth Congress, first session, and Annual Report of 1900, page 1357, et seq.

July 1, 1902, balance unexpended	\$15,000.00
June 30, 1903, amount expended during fiscal year	266.89
July 1, 1903, balance unexpended	14,733.11
July 1, 1903, outstanding liabilities	12.84
July 1, 1903, balance available	14,720.27

(See Appendix E 9.)

10. Housatonic River, Connecticut.—This is a long, shallow river running southward through Massachusetts and Connecticut, emptying into Long Island Sound east of Stratford Point, about 15 miles southwest from New Haven. At Derby, 13 miles above its mouth, it receives the discharge of the Naugatuck, a small, rapid river. This point, which has been regarded as the head of navigation, is nearly at the head of tide water. About a mile above there is a dam across the Housatonic River furnishing large water power.

The original depth on the worst bars in the river (six in number) was from 3.5 to 4.5 feet at mean low water. There was also a bar across the river mouth, with about 4 feet low-water depth.

The present and original project for improvement, adopted in 1871 and modified in 1887 and 1893, proposes making and maintaining a channel 7 feet deep at mean low water from Long Island Sound to the head of navigation, to be 100 feet wide in the river and 200 feet wide over the bar at the mouth, removing Drews rock, building a jetty at Sow and Pigs reef and a small dike at the bend below Stratford, and protecting the channel at the mouth of the river by a breakwater about 5,750 feet long. The estimated cost from the beginning, in 1871, is \$275,000. Up to close of fiscal year ending June 30, 1903, \$220,903.69 had been expended upon the project, of which \$31,704.50 had been applied for maintenance.

To July 1, 1902, Drews rock had been removed, the jetty at Sow and Pigs reef had been built, the dike below Stratford had been made 555 feet long, and the breakwater at the mouth had been made 5,821 feet long, but was not built to full cross section. Dredging had been done on the several bars in the river and at the mouth, but the former had shoaled to a depth of 4 to 6 feet and the latter to 5½ feet in places. The breakwater was in need of repair. During the last fiscal year the breakwater was repaired and the channel across the outer bar restored to project dimensions, and dredging was in progress at the close of the fiscal year on the several river bars above Stratford. On June 30, 1903, 8 feet draft at low water could be carried across the bar at the mouth of the river, thence 7 feet to Drews rock, and above that point about 4½ feet to Derby. The mean rise of tide at Derby is 4.2, and at the mouth of the river about 6.3 feet. The work done has enabled vessels to enter the lower river in safety, instead of waiting for high tide in an exposed situation outside of the mouth, and a large part of the commerce could not have been carried on without the improved channel.

The commerce is largely in coal. A considerable quantity of oyster shells are also gathered and shipped from near the mouth of the river. The tonnage for the calendar year 1902 was 40,391, a decrease of 105,714 from that reported for 1901. This decrease is probably due to a great extent to the coal strike, which prevented a great part of the normal quantity of coal from being shipped to Derby and Shelton.

The additional work proposed is necessary to maintain the improvement and extend its benefits.

For maps of the navigable part of the river, see Annual Report of 1882, page 616; House Document No. 16, Fifty-fifth Congress, first session; and at the mouth, Annual Report of 1886, page 642, and 1887, page 608.

July 1, 1902, balance unexpended	\$19, 016. 31
June 30, 1903, amount expended during fiscal year	1, 420. 00
July 1, 1903, balance unexpended	17, 596. 31
July 1, 1903, outstanding liabilities	3, 486. 20
July 1, 1903, balance available	14, 110. 11
July 1, 1903, amount covered by uncompleted contracts	3, 712. 00
(Amount (estimated) required for completion of existing project	37, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	20, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E 10.)

11. *Bridgeport Harbor, Connecticut.*—This consists of a shallow bay on the north shore of Long Island Sound, about 1 mile wide at the mouth and $1\frac{1}{2}$ miles long, into the extreme northwest of which empties the Pequonnock River, a small tidal stream navigable for about 1 mile and crossed by four drawbridges, and into the northeast corner another small stream about three-fourths of a mile long, known as Johnsons Creek. Midway between these two streams is Yellow Mill pond, a tidal basin about 1 mile in length. Black Rock Harbor, now considered part of Bridgeport Harbor, lies about $2\frac{1}{2}$ miles to the westward of the entrance to the main harbor of Bridgeport; it consists of a bay about one-half mile wide at the mouth and 1 mile long, with two branches at its head, the east one a mile long, known as Cedar Creek, and the west one about three-fourths of a mile long, known as Burr Creek. The original low-water depth on the bar at the mouth of the main harbor was about 5 feet; in the Pequonnock River, from 2 to 5 feet; in Johnsons Creek the bed of the stream was nearly bare in its upper half; the greater part of the Yellow Mill pond was about 2 to $2\frac{1}{2}$ feet above the level of mean low water. The original depth in Cedar Creek was 2 to 4 feet at low tide, and in Burr Creek the bottom was bare, or nearly so.

In 1836 Congress appropriated \$10,000, and an equal amount in 1852, for improving this harbor. These sums were expended in dredging near the mouth of the harbor, making channels 60 to 100 feet wide and 8 feet deep or more at low tide. The depth did not prove permanent.

In 1871 a project was adopted for dredging a channel 100 feet wide and 12 feet deep, and protecting the outer channels by a breakwater extending about 3,000 feet from Long Beach on the east side of the harbor, all at an estimated cost of \$124,000. In 1875, and at various times thereafter, this project was modified until at the adoption of the present project in 1899 it consisted in making and maintaining a channel from Long Island Sound to the head of navigation in the Pequonnock River, 15 feet deep at mean low water and 300 feet wide to the inner beacon, and thence to the lower bridge 15 feet deep and 200 feet wide, with a 12 feet deep anchorage; and above the lower bridge 9 feet deep and 100 feet wide; and a channel 12 feet deep and 200 feet wide in the Yellow Mill pond to the causeway; the channel and harbor were to be protected by a breakwater from the east shore of the harbor's mouth and one from The Tongue to the inner beacon, all estimated to cost \$385,000 from the beginning in 1871. This project was nearly completed, the deficiencies being mainly in the depth of the main channel inside the inner beacon and the width outside.

At Black Rock Harbor (now included in the present project for Bridgeport Harbor) between 1836 and 1838 \$21,500 was expended in building a sea wall across a breach in the southern part of Fayerweather Island, to preserve the light-house reservation at the south end of the island, and to prevent shoaling in the harbor. In 1884 a project was adopted for protecting the upper part of Black Rock Harbor by building a breakwater about one-half mile long between Fayerweather Island and the mainland, and for making a channel 80 feet wide and 6 feet deep, extending up Cedar Creek. Up to July 1, 1894, the channel had been made of the full projected dimensions, the breakwater had been built to the full length, but with reduced cross section, and the project was considered as completed. Subsequently some repairs were made on the old sea wall on Fayerweather Island. The amount appropriated for Black Rock Harbor from the beginning in 1836 up to 1895 was \$69,000.

The amount expended to June 30, 1903, on the original project and its modifications was \$317,848.50.

In the act of March 3, 1899, Congress adopted the present project for Bridgeport Harbor, which provides, at an estimated cost not exceeding \$300,000, for—

First. The main channel, 18 feet deep at mean low water, 300 feet wide from the outer bar to the inner beacon; thence 200 feet wide to the lower or Stratford Avenue Bridge.

Second. Anchorage for deep draft, 18 feet at mean low water, 500 feet wide and 2,000 feet long, adjacent to the main channel on the west and immediately above the inner beacon; for light draft, 12 feet deep at mean low water, 500 feet wide and 1,500 feet long, adjacent to the main channel on the west, between the 18-foot anchorage and Naugatuck wharf, and of the same depth at mean low water adjacent to the main channel on the east, between the steel works point and the lower bridge, extending to the harbor line.

Third. Pequonnock River channel, from the lower bridge to the head of navigation, about 1 mile, 12 feet deep at mean low water and 100 feet wide.

Fourth. Yellow Mill channel, from the main channel to the head of Yellow Mill cove, about 1 mile, 12 feet deep at mean low water and 100 feet wide.

Fifth. Johnsons River channel, from the main channel to the head of navigation, about three-fourths of a mile, 9 feet deep at mean low water and 100 feet wide.

Sixth. Black Rock channel, from the head of Black Rock Harbor to the junction of Cedar and Burr creeks, thence up each of these creeks to the head of navigation, with lengths, respectively, of $1\frac{1}{4}$ miles and one-half mile, 9 feet deep at mean low water and 100 feet wide.

Seventh. The repair and maintenance of the outer and inner breakwaters of the main channel and the one connecting Fayerweather Island with the mainland as now built, and the construction and maintenance of shore protection on Fayerweather Island to check the shifting of the beach.

An appropriation of \$50,000 was made in the act cited and a continuing contract authorized. The work is in progress.

The amount expended on the existing project to June 30, 1903, is \$61,831.67.

The net results are: A main channel 200 feet wide and 18 feet deep, full project dimensions, from the Stratford Avenue Bridge to the

inner beacon; outside of the inner beacon the western half of the channel to full depth for a distance of about one-half mile; the 12 feet anchorage and a portion of the 18 feet anchorage about 130 feet wide adjacent to the main channel dredged; the 12 feet channel 100 feet wide extending up the Pequonnock completed to within about 500 feet of the projected length; the 9 feet channel 100 feet wide extending up Johnsons River completed to a point about 700 feet above Pleasure Beach wharf; the 9 feet channel 100 feet wide in Black Rock Harbor and up Cedar Creek completed; and the Burr Creek channel of same dimensions completed for about half its length. The repair and a 380 feet extension of the east breakwater, and the construction of four jetties for shore protection on the west side of Fayerweather Island were also made, and the old sea wall or breakwater at the south end of the island has been repaired.

The maximum draft that can be carried through the improved channels at mean low tide is, about 15 feet through the main channel to a point about one-half mile outside the inner breakwater and thence 18 feet to the lower bridge; in the Pequonnock River, 12 feet to within about 500 feet of the upper end; in Johnsons Creek, 9 feet as far as the shipyard; and at Black Rock, 9 feet to the head of navigation in both branches of Cedar Creek; in Burr Creek low-water navigation is not now possible. The mean rise and fall of tide is about $6\frac{1}{4}$ feet. The year's work, by completing the 9 feet channel up Cedar Creek, affords relief to large manufacturing establishments situated on this branch of the harbor, as vessels drawing 15 feet can now go to these docks at high tide and with 9 feet draft at any time, and the completion of the main channel 18 feet deep at the turn around the inner beacon has made it possible for vessels to enter the harbor with much greater facility than formerly.

The commerce of this harbor is chiefly in coal, iron, lumber, and general merchandise. Tonnage for calendar year 1902 was 860,056 tons, a decrease of 271,766 tons from that reported for 1901, but owing to the coal strike the decrease in coal alone was 314,620 tons, so that under normal conditions the commerce for the past year would probably have shown an increase.

For details regarding surveys, estimates, or maps, see Annual Reports, 1893, page 940, and 1896, pages 803 to 805; House Document No. 61, Fifty-fourth Congress, first session; Annual Report, 1899, page 1173. For last report on Black Rock Harbor, see Annual Report 1895, page 796.

July 1, 1902, balance unexpended	\$107,001.31
June 30, 1903, amount expended during fiscal year	18,681.48
July 1, 1903, balance unexpended	88,319.83
July 1, 1903, outstanding liabilities	5,418.78
July 1, 1903, balance available	82,901.05
July 1, 1903, amount covered by uncompleted contracts	82,901.05
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement in addition to the balance available July 1, 1903..... 10,000.00	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix E 11.)	

12. *Saugatuck River and Westport Harbor, Connecticut.*—For description of these localities and statement of work under original project, 1826, and its modifications to about 1871, see Annual Report of the Chief of Engineers, 1901, page 189. The total amount expended for the same is \$19,444.

The present project was originally adopted under the appropriation made in 1892 for beginning work. It was to make a channel 4 feet deep and 60 feet wide up to Westport, at an estimated cost of \$10,000. This work was completed in 1896.

The river and harbor act of 1894 ordered a survey of Westport Harbor. The report of this survey is printed in the Annual Report of the Chief of Engineers for 1896, page 806, and with map, in House Document No. 67, Fifty-fourth Congress, first session. It proposes a further improvement to provide for repairing the Cedar Point breakwater, removing a ledge opposite Stony Point, or dredging around it, and removing bowlders from the channel, at a total estimated cost of \$8,000. Under the terms of the river and harbor act of 1896, appropriating \$3,000 for improving Westport Harbor, Connecticut, the project of 1892 was extended to include this work, and the estimated cost was in consequence increased to \$18,000.

A sketch of this river and harbor is printed in the Annual Report of the Chief of Engineers for 1894, page 670.

The total amount expended on the present project up to the close of the fiscal year ending June 30, 1903, was \$12,825.25.

The 4-foot channel had been completed to Westport, head of navigation, with width generally of 60 feet, and the Cedar Point breakwater had been repaired and extended.

No work of improvement was conducted in the past fiscal year from lack of funds. Completion of the project requires further removal of bowlders and dredging to full project dimensions at the channel opposite Westport.

The commerce comprises coal, merchandise, farm produce, and miscellaneous articles. The tonnage for calendar year 1902 was 13,379. There has been a gradual decrease of tonnage since 1897, the amounts reported for the years 1896, 1898, 1900, and 1901, being 33,507, 22,550, 18,700, and 13,626, respectively. A steam barge line makes weekly trips to New York; other vessels plying to the harbor are canal boats, barges, and schooners, making about 80 round trips per year.

Improvements made have rendered navigation of the river practicable at less than high-tide stages by vessels plying there. The mean rise of tide is about 7 feet.

July 1, 1902, balance unexpended	\$176. 70
June 30, 1903, amount expended during fiscal year	1. 95

July 1, 1903, balance unexpended	174. 75
--	---------

{ Amount (estimated) required for completion of existing project	5, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix E 12.)

13. *Harbors at Norwalk, Five-mile River, Stamford, Southport, and Greenwich, Conn.*—(a) *Norwalk Harbor.*—This harbor consists of the tidal part of Norwalk River extending from Norwalk, the head of navi-

gation, to the river mouth, about 3 miles, and of an outer harbor lying between Norwalk Islands and the mainland. South Norwalk is on the west bank, about $1\frac{1}{2}$ miles below Norwalk. The original depth up to South Norwalk was about 5 feet; between there and Norwalk the river bed was nearly bare at low tide.

The original project, adopted in 1872 and modified in 1880, provided for a channel 100 feet wide and 8 feet deep to South Norwalk, and thence 6 feet deep to Norwalk. This project was completed in 1892 at a cost of \$83,000.

The present project, adopted by the river and harbor act of 1894 and modified by the act of 1896, is to dredge a channel from the outer harbor to the railroad bridge at South Norwalk 10 feet deep and 150 feet wide, to widen two bends at the harbor entrance to from 250 to 300 feet wide, and to remove the shoal at Ferrys Point, a short distance below Norwalk, to a depth of 6 feet. The estimated first cost was \$77,000, and the estimated yearly expenditure for maintenance of this channel and of the channel above South Norwalk \$2,000.

The amount expended on this project to June 30, 1903, is \$40,148.73. Of this amount \$5,902 was expended for maintenance. Completion of the project substantially resulted from the operations of the last fiscal year. The maximum draft that can be carried to the South Norwalk docks is 10 feet at low water, and to the Norwalk docks about 6 feet. The mean rise of tide is 7.1 feet.

The commerce of this harbor is mainly in coal, oysters, lumber, and general merchandise. Traffic for calendar year 1902 amounted to 194,800 tons, an increase of 44,786 tons over the preceding year. A line of two freight steamers runs daily to New York.

For further details regarding this harbor and former projects see page 191, Annual Report of the Chief of Engineers, 1901. For report on last survey see page 813, Annual Report of the Chief of Engineers, 1896, and for map of same, House Document No. 50, Fifty-fourth Congress, first session.

(b) *Five-mile River Harbor*.—This is a tidal inlet over a mile long and from 100 to 1,000 feet wide. The natural low-water depth at the mouth was about 3 feet, shoaling to zero about half way up the harbor and to about plus 2.5 at extreme head. The original and present project of improvement was adopted by the act of August 11, 1888, and provides for a dredged channel 8 feet deep and 100 feet wide, extending up the harbor about 6,000 feet from its mouth; the estimated cost from the beginning, as revised in 1894, was \$45,000. The amount expended on this project to June 30, 1903, is \$26,983.93. Of this amount \$1,817.53 was expended for maintenance.

The net result of the work to date is a channel of project dimensions extending about 3,200 feet up the harbor from its outer end, and thence about 1,500 feet farther with project depth and widths of from 50 to 70 feet. No dredging has been done above this point. The maximum draft that can be carried to the upper end of the improved channel is 8 feet at low water, and no navigation is possible beyond this point except at high tide, when a draft of from 4 to $4\frac{1}{2}$ feet can be carried about 2,000 feet farther to the head of navigation. The removal of about 70,500 cubic yards more is required to complete the project. The mean rise of tide is 7.2 feet. The commerce of this locality is almost entirely in oysters. Traffic for calendar year 1902 amounted to 9,128 tons of oysters and oyster shells, valued at \$156,225.

This is a decrease of 19,272 tons from that reported for 1901. This large decrease is due to the fact that the past year has been an exceptionally poor one for the oyster industry, and no coal at all was received, owing to the strike. For further details regarding this harbor see page 192, Annual Report of the Chief of Engineers, 1901.

(c) *Stamford Harbor*.—This consists of a bay on the north shore of Long Island Sound, and of two tidal inlets known as the east and west branches, extending up to the city of Stamford, the head of navigation. The original depth in the west branch was from 1 foot to 3 feet, gradually increasing in the bay to a depth of 12 feet; the east branch was originally a small marshy creek, deepened by private dredging to a depth of about 8 feet. This had shoaled so that when work was begun by the Government in 1892 the available depth was only about $6\frac{1}{2}$ feet. The original project, adopted by the river and harbor act of 1896, was for a 5-foot channel 80 feet wide up to the head of the west branch. This was reported as completed in 1892, after an expenditure of \$20,000.

The present project, adopted by the act of July 13, 1892, provides for a channel in the west branch 7 feet deep, 150 feet wide, and about $1\frac{1}{2}$ miles long, with a basin of same depth between harbor lines at the head of the harbor, and in the east branch a channel 9 feet deep and 100 feet wide for a length of 8,535 feet, and 50 feet wide for about 1,200 feet farther to the head of the harbor; the estimated cost was \$123,500. A modification to give increased width at upper end of east branch was approved February 12, 1901. The amount expended on this project to June 30, 1903, is \$50,444.47. Of this amount \$3,267 was expended for maintenance.

The channel in the east branch now affords project depth and widths of from 70 to 100 feet from the entrance to the steamboat dock; the remaining section above this point is completed, the widths ranging from 65 to 70 feet. The channel in the west branch has been dredged to project dimensions from its outer end to the harbor line at the head, but it has since shoaled and narrowed, particularly at the upper end, so that the available depth that can be carried to the extreme head is only about 6 feet. The completion of the project requires dredging the basin and portions of the channel in the west branch and widening portions of the channel in the east branch, including rock removal. The mean rise of tide is 7.4 feet. The commerce of this harbor consists mainly of coal, lumber, miscellaneous building material, and general merchandise. Traffic for calendar year 1902 amounted to 166,549 tons, which is less by 100,329 tons than that reported for 1900; no report was received for the calendar year 1901. The large decrease in tonnage is accounted for to a considerable extent by the falling off in the receipts of coal due to strikes. A line of two freight steamers, landing in the east branch, runs daily to New York. The improvements made during the past year have rendered it possible for these steamers to run on schedule time and to enter the harbor at any stage of the tide, which they were unable to do previously.

For further details regarding this harbor and projects for improvement see page 194, Annual Report of the Chief of Engineers, 1901.

(d) *Southport Harbor*.—This is a tidal estuary about 1 mile long and averaging less than 100 yards wide, about 6 miles west of Bridgeport. The original depth at low tide was probably less than 2 feet at the entrance to the harbor, shoaling to about plus 1 foot at the upper end. Work was begun in this harbor by the Government in 1829, and prose-

cuted with various intermissions until 1878. During this time a dike and breakwater pier were built, and a channel dredged 60 feet wide and 4 feet deep across the bar. In 1878 a project was adopted for dredging a channel 100 feet wide and 4 feet deep across the bar and upstream 1,200 feet from the outer end of the pier, and thence in a bifurcated channel to the nearest docks. In 1882 this project was reported as substantially completed, \$31,587.43 having been spent since the beginning of work in 1829.

The present project, authorized by the act of July 13, 1902, is to dredge a channel 6 feet deep through the outer bar to the upper docks 100 feet wide, to the turn above White Rock, and thence in two branches each 60 feet wide; to repair the breakwater and to remove two points of ledge from the channel to a depth of 7 feet. The estimated first cost of this improvement was \$12,700, and for yearly maintenance, \$300 to be expended biennially. The amount expended upon the project to June 30, 1903, is \$7,545.54.

The improved channel permits vessels to enter the harbor without being compelled to wait outside the bar in an exposed situation for the tide to rise. The maximum draft that can be carried through the improved portion of the channel is 6 feet at low tide. Above this point where no dredging has been done draft of $2\frac{1}{2}$ to 3 feet can be carried to the docks at low tide. Above the upper end of the projected channels the harbor is navigable only at high tide, and for a distance of about a half mile. The removal of two points of ledge to a depth of 7 feet and about 48,700 yards of dredging are required to complete the project. The mean rise of tide is about 6.6 feet. The commerce of this harbor consists mainly of coal and farm produce. The traffic in 1896, when last reported, was 25,145 tons.

For further details regarding this harbor and its former projects for improvement see report of survey published in House Document No. 112, Fifty-fourth Congress, second session, in Annual Report of the Chief of Engineers, 1897, page 986.

(e) *Greenwich Harbor*.—This is a shallow bay about 2 miles east from the New York State line, extending about a mile northward from Long Island Sound. The original low water depth was about 6 feet up to the lower docks. Above this point it shoaled rapidly to 3 feet a 1,000 feet above, and to about plus 2 at the head of the harbor. The original and present project, adopted under the act of June 3, 1896, is to dredge a channel 90 feet wide from mouth of harbor to causeway at its head, a distance of about a mile, to be 9 feet deep to the steamboat dock and 6 feet deep above, the upper end to be enlarged to form a turning basin. The estimated first cost was \$20,000. The amount expended on this project to June 30, 1903, is \$12,643.66. Of this amount \$731 was expended for maintenance. The net result of the work to date is a 9-foot channel 90 feet wide from Long Island Sound to the lower dock; thence 9 feet deep and 45 feet wide to the steamboat dock, and above this 6 feet deep and 80 feet wide to the turning basin, the southwest portion of which was developed, giving project depth along its western and southern sides. The work of the last year has enabled vessels to enter the harbor with 9 feet draft at low tide, thus permitting the regular steamer to make trips without waiting for tide. Above the steamboat dock a draft of 6 feet can be carried at mean low water to the turning basin or head of navigation. The completion of the project requires the widening to 90 feet of a

portion of the channel about 1,000 feet long and now 45 feet wide, between the lower dock and the steamboat dock, and above this widening the 6-foot channel, now 80 feet wide, to 90 feet, and dredging the remainder of the turning basin—all estimated to require the removal of about 27,000 cubic yards. The mean rise of tide is about 7.5 feet.

The commerce of this harbor consists mainly of coal, lumber, building material, and general merchandise. Traffic for calendar year 1902 amounted to 131,034 tons, a decrease of 268,966 tons from that reported for the previous year. This decrease is due in part to the coal strike, but probably largely to the fact that the amount reported for 1901 was an excessive estimate. A regular freight and passenger steamer makes daily trips to New York for three months, and tri-weekly trips during the remainder of the year. The number of passengers carried during the calendar year 1902 was 3,000.

For report on preliminary examination of this harbor, see House Executive Document No. 25, Fifty-third Congress, third session, and Report of the Chief of Engineers for 1895, page 860.

July 1, 1902, balance unexpended	\$45,193.17
June 30, 1903, amount expended during fiscal year	42,459.50

July 1, 1903, balance unexpended	2,733.67
July 1, 1903, outstanding liabilities	175.93

July 1, 1903, balance available	2,557.74
---------------------------------------	----------

(Amount (estimated) required for completion of existing project	137,700.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	44,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

• (See Appendix E 13.)

14. *Harbor at Coscob and Mianus River, Connecticut.*—For description of this harbor, see page 195, Annual Report of the Chief of Engineers for 1901. A sketch of the harbor is printed in the same for 1893, page 958, and one of the lower part of the harbor in the report for 1895, page 882.

The original and present project of improvement was adopted by the river and harbor act of 1892 and modified by the river and harbor act of 1896. The project provides for a dredged channel 1.2 miles long and 6 feet deep, 150 feet wide from its outer end to the railroad bridge, 0.4 mile, and thence 100 feet wide to Mianus, at the head of the harbor; also for a turning basin near the lower end 300 feet by 1,750 feet and 7 feet deep, all at an estimated cost of \$54,000. The amount expended upon the project to June 30, 1903, is \$18,935.19. The channel of project depth and widths has been dredged from its outer end to a point 1,600 feet above the bridge; also one-half of the turning basin has been dredged. No impairment of this channel or of the part of the basin dredged has been reported. Above the improved channel to the head of the harbor the limiting depths are 2 feet at mean low water. The mean rise of tide is 7.5 feet. No improvement was done during the past fiscal year.

The commerce is mainly in coal and oysters. Larger vessels load

to 8 feet. The tonnage of the harbor was reported for 1897 as 61,500, for 1901 as 8,062, and for 1902 as 7,520. The engineer officer in charge states that this harbor is not worthy of further improvement.

July 1, 1902, balance unexpended	\$70. 31
June 30, 1903, amount expended during fiscal year	5. 50

July 1, 1903, balance unexpended	64. 81
--	--------

Amount (estimated) required for completion of existing project	35,000. 00
--	------------

(See Appendix E 14.)

IMPROVEMENT OF RIVERS AND HARBORS IN NEW YORK ON LONG ISLAND SOUND AND ON THE SOUTHERN SHORE OF LONG ISLAND; OF HUDSON RIVER AND HARBORS THEREON, AND OF HARLEM AND EAST RIVERS, NEW YORK.

This district was in the charge of Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, United States Army, retired), until February 25, 1903, and of Col. Amos Stickney, Corps of Engineers, since that date, having under his immediate orders Lieut. John R. Slattery, Corps of Engineers, since April 24, 1903.

1. *Port Chester Harbor, New York.*—This harbor, situated at the boundary between the States of New York and Connecticut, consists of the tidal part of Byram River and of a bay at its mouth opening into Long Island Sound.

The depth in the river before improvement was 1 foot; and Salt rock, in the river, and Sunken rock, in the bay, were considered to be dangerous obstructions.

The original project for this improvement was adopted in 1872 and modified in 1884 and 1888. It proposed to remove Salt rock to 9 feet below mean low water, to build a breakwater from Sunken Rock to Byram Point, and to dredge and maintain a channel to the Port Chester wharves, at a total cost of \$57,000. Up to 1899, at a total cost of \$52,000, this project had been completed, except the dredging in the upper harbor.

The existing project, approved March 3, 1899, provides for a channel 12 feet deep and 70 feet wide from deep water in the bay up to the town wharf, and thence 9 feet deep and 60 feet wide to the steamboat wharf, the work to be done by dredging and rock removal. Estimated cost, \$25,000.

Up to June 30, 1903, \$22,951.61 had been expended on present project.

Expenditures during the past year have been for dredging for maintenance.

The work done under the present project has resulted in the completion of a channel of the proposed depth and width, except at and opposite the southerly point of Fox Island, where the width is only about 60 feet.

The maximum draft that could be carried June 30, 1903, at mean low water in the center of the channel was about 12 feet up to the town wharf, and thence about 9 feet to the steamboat wharf, and above the steamboat wharf 2½ feet. Mean range of tides, 7.4 feet. The channel has narrowed by shoaling.

The commerce of this harbor, mainly in coal, building materials, manufactured goods, and farm produce, amounted to 140,000 tons in 1898, to 169,500 tons in 1899, to 181,000 tons in 1900, to 327,500 tons in 1901, and to 237,000 tons in 1902.

Detailed description of this improvement is printed in Report of the Chief of Engineers for 1897, pages 1084 and 1085. Sketches of the river and harbor are printed in the Annual Reports for 1885, page 658, and for 1889, page 716.

July 1, 1902, balance unexpended	\$7, 140. 29
July 30, 1903, amount expended during fiscal year.....	91. 90
July 1, 1903, balance unexpended	7, 048. 39
July 1, 1903, outstanding liabilities	1, 970. 85
July 1, 1903, balance available	5, 077. 54
July 1, 1903, amount covered by uncompleted contracts.....	3, 029. 15
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	2, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F 1.)

2. *Mamaroneck Harbor, New York.*—This harbor, situated on the north shore of Long Island Sound, consists of a narrow inlet opening into a shallow, broad bay.

Before improvement, the channel to the old steamboat wharf, half a mile up the inlet, had a depth of 5 feet at mean low water, gradually decreasing to 1 foot at the upper wharves. Various rocks at or near the mouth of the inlet obstructed navigation.

The present project, approved August 2, 1882, and modified April 27, 1899, provides for the removal of Round rock to a depth of 4 feet, and Bush rock and Inner Steamboat rock to a depth of 7 feet, and for making a channel 7 feet deep and 100 feet wide from the harbor entrance to the upper wharves. Estimated cost, \$43,000.

Up to June 30, 1903, there had been expended on this work \$31,982.

No work was done during the past fiscal year, but a contract was made to widen to 100 feet and to dredge channel for maintenance in the latter part of May.

The work done under the present project has resulted in a channel 7 feet deep and 100 feet wide from the 7-foot curve at the entrance to the old steamboat wharf, a distance of 2,500 feet, and 7 feet deep, and from 70 to 90 feet wide from there to the upper wharves, a distance of 2,600 feet. Shoaling has occurred in places.

The maximum draft that could be carried June 30, 1903, estimated to be 5 feet. Mean range of tides, 8 feet.

The commerce of this harbor is principally coal and building materials, and was reported as amounting to 29,095 tons in the year 1896, 51,673 tons in 1897, 64,685 tons in 1900, 20,705 tons in 1901, and 48,495 tons in 1902.

A detailed description of this improvement can be found in Report of the Chief of Engineers for 1900, page 1381. Sketch of harbor is printed in Report of the Chief of Engineers for 1886, page 658, and also in this report.

July 1, 1902, balance unexpended	\$6, 039. 60
June 30, 1903, amount expended during fiscal year	21. 60
July 1, 1903, balance unexpended	6, 018. 00
July 1, 1903, amount covered by uncompleted contracts	5, 000. 00
(Amount (estimated) required for completion of existing project	5, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance unexpended July 1, 1903	3, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix F 2.)

3. *Larchmont Harbor, New York.*—This harbor, situated on the northwest shore of Long Island Sound, 4 miles distant from New York City limits, is about half a mile wide and five-eighths of a mile long. It is exposed to easterly and southerly storms. Two submerged rocks (Umbrella rock and Huron rock) obstruct the entrance, which has a depth of 18 feet, gradually diminishing toward the head of the bay.

The original project for this improvement, adopted September 19, 1890, provided for building two breakwaters to protect the anchorage ground, one to extend from Umbrella rock to Umbrella Point and the other from Huron rock to Long Beach Point, at an estimated cost of \$105,000. Work under this project was suspended in 1891, after the first appropriation of \$5,000 had been expended in commencing the two breakwaters.

The present project, approved March 3, 1899, provides for building a breakwater extending southwardly 1,440 feet from the 6-foot curve off Long Beach Point and for the removal of Huron rock to a depth of 14 feet at mean low water. Estimated cost, \$108,000.

Up to June 30, 1903, there had been expended on this project \$52,165.26.

The expenditure during the fiscal year ending June 30, 1903, was applied to removing Huron rock breakwater and Huron rock, the stone being used to strengthen the breakwater off Long Beach Point.

The maximum draft that could be carried June 30, 1903, over the shoalest part of the entrance channel, at mean low water, was 18 feet.

The general depth of the anchorage area of the harbor is from 6 to 12 feet at mean low water. Mean range of tides, 7.4 feet.

The commerce of the harbor is not large. It is mainly used by the Larchmont Yacht Club, and also by coasting and fishing vessels for night anchorage and as a harbor of refuge.

Detailed description of this improvement is printed in the Report of the Chief of Engineers for 1900, pages 1383–1387.

A sketch of Larchmont Harbor is printed in House Executive Document No. 40, Fifty-first Congress, first session, and also in this report.

July 1, 1902, balance unexpended	\$10, 000. 00
June 30, 1903, amount expended during fiscal year	2, 165. 26
July 1, 1903, balance unexpended	7, 834. 74
July 1, 1903, outstanding liabilities	2, 193. 38
July 1, 1903, balance available	5, 641. 36
July 1, 1903, amount covered by uncompleted contracts	4, 279. 40
(Amount (estimated) required for completion of existing project	48, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1906, in addition to the balance available July 1, 1903	20, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix F 3.)

4. *Harbor at Echo Bay, New York.*—The original project for improvement, adopted in 1875, provided for the removal of two ledges, known as Start rock and Sheepshead reef, to 7 and 9 feet depth, respectively, at an estimated cost of \$38,955.38.

Prior to 1902 the sum of \$22,000 had been appropriated, with which Start rock was reported wholly, and Sheepshead reef partly, removed to the projected depths and a channel 40 feet wide and 4 feet deep at mean low water dredged from Beauford Point to within 300 feet of the head of the harbor. A projecting point has been reported on Start rock.

The project adopted by the river and harbor act of June 13, 1902, contemplates completion of the original plan by the removal of the remainder of Sheepshead reef and Start rock, at an estimated cost of \$17,000.

The present project is printed in House Document No. 235, Fifty-sixth Congress, first session, and in the Report of the Chief of Engineers for 1900, page 1429.

During the latter part of the past fiscal year work has been in progress on the removal of Sheepshead reef.

On June 30, 1903, there had been expended on this project \$22,335.07, with the result reported above.

A sketch of the locality accompanies this report.

July 1, 1902, balance unexpended	a \$17,000. 00
June 30, 1903, amount expended during fiscal year	335. 07
July 1, 1903, balance unexpended	16, 664. 93
July 1, 1903, outstanding liabilities	3, 510. 00
July 1, 1903, balance available	13, 154. 93
July 1, 1903, amount covered by uncompleted contracts	7, 790. 00

(See Appendix F 4.)

5. *Bronx River and East Chester Creek, New York.*—(a) *Bronx River.*—This stream empties into the East River north of Hunts Point. The navigable part extends from its mouth to West Farms, a distance of 3 miles. At this point it is crossed by a dam.

The natural depth at the mouth was 4 feet at mean low water, and decreased ascending the stream to less than 1 foot at the head of navigation.

The project for improvement, approved June 3, 1896, provides for making a channel 4 feet deep and 100 feet wide at and near the mouth, thence decreasing in width to 50 feet at the head of navigation, the work to be done by dredging and rock removal. Estimated cost, \$85,985.

Up to June 30, 1903, there had been expended on this improvement \$28,545.57. No work was done during the past fiscal year. Bids for redredging were rejected in May as too high. New proposals were called for, to be opened July 10, 1903.

The maximum draft that could be carried June 30, 1903, over the shoalest part of the channel at mean low water up to Stephens's dock was 3 feet; above that point 1 foot. Mean range of tide is 6.6 feet at mouth and 6 feet at West Farms.

The commerce of this river is mainly lumber, building materials,

a Erroneously reported last year as \$10,000.

cotton goods, drugs for dyeing purposes, and ice. It amounted to 139,310 tons in 1897, 171,300 tons in 1899, 166,500 tons in 1900, 168,000 tons in 1901, and 153,137 tons in 1902. The navigation of the river has been greatly benefited by work already accomplished.

Details of improvement can be found in Report of the Chief of Engineers for 1897, page 1093.

(b) *East Chester Creek*.—This is a small tidal stream emptying into Pelham Bay. It was originally navigable at high tide for vessels drawing 7 feet as far as Lockwoods, a distance of $2\frac{1}{4}$ miles.

The project for improvement, approved March 3, 1873, provided for a channel 100 feet wide and 9 feet deep, mean high water, from deep water in Pelham Bay to a point 3,000 feet above Lockwoods. Estimated cost, \$136,500; subsequently reduced to \$124,000.

Up to June 30, 1903, there had been expended on this work \$91,001.69, of which amount \$910.47 was for maintenance.

No work was done during the past fiscal year. Bids were opened in May for redredging for maintenance, but were rejected. New bids were to be opened on July 10, 1903.

This improvement is completed, and its condition is about as stated in Report of the Chief of Engineers for 1900, page 1388. Shoaling has occurred in places.

The maximum draft that could be carried June 30, 1903, over shoalest part of channel at mean high water can not be certainly stated, as some shoaling has taken place, but is believed to be about $8\frac{1}{2}$ feet. Mean range of tides, 7.1 feet.

The commerce, mainly coal, building material, stone, and miscellaneous freight, amounted to 94,928 tons in 1896, 286,428 tons in 1899, 300,475 tons in 1900, 225,357 tons in 1901, and 99,750 tons in 1902.

For detailed reports, see Report of the Chief of Engineers for 1900, page 1081. A sketch of the stream is printed in Report of the Chief of Engineers for 1893, page 968.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$9,572.69
June 30, 1903, amount expended during fiscal year	119.95

July 1, 1903, balance unexpended	9,452.74
--	----------

{ Amount (estimated) required for completion of existing project	55,985.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	28,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F 5.)

6. *Harbors at Port Jefferson, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, New York*.—(a) *Port Jefferson Harbor*.—This is a large and deep inland bay, situated on the north shore of Long Island, and connected with Long Island Sound by a narrow entrance.

Before improvement the channel depth outside the entrance was but 4 feet at mean low water, whereas the depth in the harbor was 12 feet and more at low tide up to within 300 feet of the wharves of Port Jefferson village. The first project for improvement was adopted in

1871 and completed in 1883, at a total cost of \$79,000. Two jetties were built to shelter the inlet channel, one east of the inlet, 1,390 feet long, and one west, 940 feet, both of scant cross section. A channel 8 feet deep at mean low water and 100 feet wide was dredged through the inlet and the shoal outside. The existing project for improvement, approved September 19, 1890, and modified August 18, 1894, provides for dredging a channel through the harbor entrance 12 feet deep and 200 feet wide, to be protected by extending and enlarging the previously built jetties. Estimated cost, \$145,000.

The expenditure on the present project up to June 30, 1903, amounted to \$57,267.43.

The maximum draft that could be carried over the shoalest part of the channel June 30, 1903, was 12 feet at mean low water. Mean range of tides at entrance, 7 feet; at Port Jefferson wharves, 6.2 feet. The commerce consists principally of coal, building materials, farm produce, fish, and general merchandise, and amounted to 24,940 tons in 1898, 42,130 tons in 1899, 40,380 tons in 1900, 38,200 tons in 1901, and 54,000 tons in 1902.

For detailed reports, see Report of the Chief of Engineers for 1900, page 1393.

A sketch of Port Jefferson is printed in the Annual Report of the Chief of Engineers for 1886, page 660, and also in this report.

(b) *Huntington Harbor*.—This harbor is a narrow tidal estuary extending inland from Huntington Bay, Long Island, in a southerly direction, for a distance of about 2 miles.

Before improvement it had a natural available depth of nearly 8 feet, mean low water, for a stretch of $1\frac{1}{4}$ miles from the entrance southward, thence gradually decreasing to zero toward the head of the harbor.

In 1872 the first project was adopted under which, in 1873, a shoal at the harbor entrance was removed and a channel 2,200 feet long, 130 to 150 feet wide, and 8 feet deep, at mean low water, was dredged up to the town landings, at a total cost of \$22,500. In 1884 this channel had completely filled up.

The present project, adopted September 19, 1890, provides for dredging and maintaining a channel, 8 feet deep and 100 feet wide, up to the upper wharves, to be protected by piling if necessary. Estimated cost, \$32,000.

Up to June 30, 1903, there had been expended on this project \$29,489.06.

No work was carried on during the past fiscal year. Bids for redredging for maintenance were advertised for, but no bid was received. New bids were advertised for, which were to be opened July 10, 1903.

The maximum draft that could be carried June 30, 1903, can not be certainly stated, due to shoaling of unknown extent, but it is believed to be about 7 feet. Mean range of tide, 7.2 feet.

The commerce of the harbor consists mainly of coal, farm produce, building material, and miscellaneous merchandise, and amounted to 23,584 tons in 1897, 46,500 tons in 1899, 45,600 tons in 1900, and 52,000 tons in 1901.

For detailed description, see Report of the Chief of Engineers for 1897, pages 1100 to 1102.

A sketch of the upper part of the harbor is printed in the Annual Report for 1893, page 976.

(c) *Glencove Harbor*.—This harbor is a small tidal inlet on the east side of Hempstead Harbor, Long Island. Its channel is about 2 feet deep at mean low water, and a bar at the entrance has a foot less depth. Before improvement vessels waiting for tides to enter the harbor were exposed to storms from the north and northwest. Range of tide, 7.7 feet.

The existing project, approved August 11, 1888, and revised June 22, 1895, provides for the construction of a breakwater in Hempstead Harbor, extending from the northwest corner of Glencove dock west-southwestwardly toward Motts Point, so as to shelter the anchorage outside of Glencove Harbor. This breakwater is to have a length of 2,000 feet and to be built to a height of 3 feet above high water, with a top width of 5 feet. Estimated cost, \$135,000.

Up to June 30, 1903, there had been expended in carrying out the work \$63,073.33.

Expenditures during the past year have been for repairing and strengthening breakwater.

The breakwater is now 1,465 feet long, 3 feet wide on top, and 4 feet above mean high water. The work contains about 1,799 tons of riprap. It is believed that the breakwater was constructed a foot higher than called for in project to allow for settling.

The commerce of the harbor is chiefly coal, grain, building materials, and general merchandise, and amounts to about 700,000 tons annually.

For details of improvement, see Report of the Chief of Engineers for 1897, page 1103. A map is printed in Report of the Chief of Engineers for 1889, page 728.

(d) *Flushing Bay*.—Before improvement the controlling depth up to Flushing was 3.9 feet, mean low water.

The existing project, approved March 3, 1879, and modified September 19, 1888, and June 9, 1891, provides for building a dike 4,663 feet long on the west side of the channel, to protect it from filling, and for making and maintaining a channel 6 feet deep and 200 feet wide at mean low water up to the lower bridge at Flushing. Estimated cost, \$173,500.

Up to June 30, 1903, there had been expended on this improvement \$122,540.53. During progress of work it was repeatedly necessary to redredge some parts of the channel, so that it is not possible to state what part of above sum was used for maintenance.

The dike, 4,663 feet long, is in bad condition. The outer part, 1,606 feet long, which was left partly completed in 1891, has since been nearly destroyed by storms and ice. Further work on the dike was discontinued because of opposition of property owners on shore. A small light is maintained on the outer end of the dike by the Light-House Department.

The maximum draft that could be carried June 30, 1903, can not be certainly stated, due to shoaling of unknown extent, but is believed to be about 5 feet at mean low water. Mean range of tides, 7.1 feet.

No work was carried on during the year. Bids for redredging channel were called for, but were rejected as too high. New bids were to be opened July 10, 1903.

The commerce consists chiefly of coal, building materials, dyewoods, and miscellaneous merchandise, and amounted to 163,395 tons in 1897,

158,755 tons in 1899, 177,575 tons in 1900, 200,473 tons in 1901, and 186,000 tons in 1902.

For detailed description of improvement, see Report of the Chief of Engineers for 1897, page 1106. A map is printed in the Report of the Chief of Engineers for 1889, page 732, and also in this report.

It is expected that report of survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

(e) *Canarsie Bay*.—This bay forms the northwest part of Jamaica Bay at Canarsie Landing. The original depth from the landing to Big channel was 4.2 feet and to Island channel 1.3 feet at mean low water.

The project for this improvement, approved June 14, 1880, and subsequently enlarged in 1889 and 1896, provides for the construction of two dikes and dredging between them where necessary to secure a channel 100 to 150 feet wide and 6 feet deep, connecting the steamboat dock at Canarsie with Big channel, Jamaica Bay; also for a channel 4 feet deep and about 50 feet wide running in a southwesterly direction from Canarsie Landing to Island channel, and for a channel 5 feet deep and 50 feet wide running in a northeasterly direction to Gophel channel. Estimated cost, \$88,000.

Up to June 30, 1903, there had been expended in carrying on this improvement \$64,748.21.

No work was in progress during the year.

The maximum draft that could be carried June 30, 1903, over the shoalest part of channel at mean low water was 5 feet in the main channel, 2½ feet in the West Branch, and 3½ feet in the East Branch. Mean range of tides, 4.7 feet.

The commerce of Canarsie Bay is mainly in building materials, fertilizers, fish, and coal, and amounted to 50,000 tons in 1896. The commerce in Jamaica Bay was greatly benefited by the improvement, and amounted to 450,000 tons in 1901. No data could be obtained for 1902.

Details as to this improvement may be found in Report of the Chief of Engineers for 1897, page 1114. A sketch of Canarsie Bay is printed in the Report of the Chief of Engineers for 1882, page 670.

(f) *Harbor at Sag Harbor*.—This harbor lies on the northern shore of Long Island, about 24 miles west of Montauk Point. It is a small bay, sheltered by Long Island on the south and west and partly by Shelter Island on the north.

The project adopted June 13, 1902, consists in constructing a breakwater 3,180 feet long from Conklin Point, at an estimated cost of \$71,000.

There had been expended on this improvement on June 30, 1903, \$941.20.

The expenditure has been in building the shore arm of the breakwater. But little has been accomplished.

It has been impossible to gather any commercial statistics for 1902. The commerce in 1898 amounted to 35,021 tons.

For detailed report, see Report of the Chief of Engineers for 1900, page 1451. A sketch of the harbor accompanies this report.

July 1, 1902, balance unexpended	\$40,708.55
June 30, 1903, amount expended during fiscal year	1,268.31
July 1, 1903, balance unexpended	39,440.24
July 1, 1903, outstanding liabilities	4,251.33
July 1, 1903, balance available	35,188.91
July 1, 1903, amount covered by uncompleted contracts	17,391.31
(Amount (estimated) required for completion of existing project	279,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.	72,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F 6.)

7. *East River and Hell Gate, New York.*—East River, a tidal strait separating New York City from Long Island, extends from the Battery to Throgs Neck, a distance of about 16 miles. In its original condition it was obstructed by rocks and reefs, especially in the part known as Hell Gate.

The improvement of this waterway was commenced in 1852, under a project prepared in 1848, which contemplated the removal of rocks at Hell Gate and Diamond reef.

The amount expended under this project was \$33,861.59.

The existing project for improvement, adopted in 1868 and modified in 1870, 1874, 1884, 1889, 1890, and 1899, provides for the removal of rocky obstructions from the channel between the Battery and Baretto Point to depths varying from 18 to 26 feet, and for the construction of sea walls and dikes where necessary to guide the tidal currents.

The cost of the work was estimated at \$5,639,120.

The amount expended in carrying out this project to the close of the fiscal year ending June 30, 1903, was \$4,634,435.25, no portion of which was applied to maintenance.

This expenditure has resulted in the removal to the contemplated depths of Diamond reef, reef off Diamond reef, Coenties reef, Charlotte rock, Hallets Point, Ways reef, Shell Drake, Scaly rock, reef at middle ground off Sunken Meadow, North Brother Island reef, reef off Baretto Point, Twenty-sixth street reef, Man-o'-War rock, Third street reef, and in the partial removal of Battery reef, reef off South Ferry slips, Shell reef, Pilgrim rock, Ferry reef off Thirty-fourth street, Middle reef, including Flood rock, Gridiron, Hen and Chickens, and Negro Heads, Frying Pan, and Pot rocks.

A maximum draft of 26 feet at mean low water could be carried, June 30, 1903, through the main channel of the river from the Battery to Long Island Sound. The following are the least depths at localities where improvement has not been completed:

Localities.	Least depth, June 30, 1903.
	<i>Fect.</i>
Battery reef	19
Reef off South Ferry slips	19
Shell reef, off Ninth street	15
Pilgrim rock, off Nineteenth street	24
Ferry reef, off Thirty-fourth street	24
Middle reef	24
Heel Tap	18.3
Frying Pan	20.6
Pot rock	18
	22.3

The range of tide south of Hell Gate is from $4\frac{1}{2}$ to 5 feet, and east of it from 5 to 7 feet.

The traffic on East River is very great, and is intimately connected with that of New York Harbor proper. It is impracticable to show what proportion properly belongs to the East River, especially as the heaviest coastwise traffic passing through this waterway is carried on in vessels which do not enter or clear at the custom-house.

July 1, 1902, balance unexpended	\$138,253.15
June 30, 1903, amount expended during fiscal year	39,346.95

July 1, 1903, balance unexpended	98,906.20
--	-----------

{ Amount (estimated) required for completion of existing project	905,778.55
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	250,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix F 7.)

8. *Harlem River, New York.*—The Harlem River and Spuyten Duyvil Creek, both included in the improvement, are two waterways which join at Kingsbridge, N. Y., and separate Manhattan Island from the mainland. The narrow channel at their junction was obstructed by a ledge of rocks, awash at low tide.

Before improvement the Harlem River had an available depth of 10 feet from the East River to Morris Dock, except at Highbridge, where it was only 6 feet. From Morris Dock to Fordham Landing there was a crooked channel 7 feet deep, and above the latter place the river could be used only by the smallest class of vessels.

Spuyten Duyvil Creek, from Kingsbridge to the Hudson, had a depth of 4 feet.

The original project for improvement, adopted in 1874, provided for the removal of old bridge piers, Candle Factory reef, and bowlders at various places near the East River to a depth of 12 feet, the cost of the work being estimated at \$167,875.56. In furtherance of this project \$21,000 was expended.

The existing project, adopted June 18, 1878, and modified October 7, 1886, provides for a continuous channel, 400 feet wide and 15 feet deep, from the East River to the Hudson River, except just north of Highbridge, where the width was made 375 feet, and the rock cut through Dyckman's meadow, where the width was reduced to 350 feet and the depth increased to 18 feet. The cost of the work was estimated at \$2,700,000.

The amount expended in carrying on work under the existing project to the close of the fiscal year ending June 30, 1903, was \$1,244,851.90.

The maximum draft that could be carried June 30, 1903, over the shoalest part of the channel was 12 feet.

Expenditures during the past year were for redredging for maintenance near the bridges, and for further improvement of upper part of channel.

The commerce of this river is very large. In 1895 the tonnage amounted to over 7,500,000 tons.

To complete this improvement to the best advantage contracts should be authorized in advance of appropriations for the remainder of the work.

For detailed descriptions, see Reports of the Chief of Engineers for 1887, pages 665-689, and 1897, page 1019 et seq.

July 1, 1902, balance unexpended	\$76,297.22
June 30, 1903, amount expended during fiscal year	1,149.12
July 1, 1903, balance unexpended	75,148.10
July 1, 1903, outstanding liabilities	5,788.64
July 1, 1903, balance available	69,359.46
July 1, 1903, amount covered by uncompleted contracts	59,211.36
{ Amount (estimated) required for completion of existing project	1,380,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix F 8.)

9. *Newtown Creek, New York.*—This creek, an inlet of the East River, extending inland between Kings and Queens counties, New York, for a distance of about 4 miles, had a natural depth varying from 12½ feet at the mouth to 4 feet at the head of navigation.

The original project adopted in 1880 and modified in 1884 provided for a channel 240 feet wide and 21 feet deep from the mouth to the Vernon Avenue Bridge, thence to the head of navigation on both branches for channels decreasing from 175 to 100 feet in width and from 18 to 10 feet in depth. The cost of the work was estimated at \$255,500. In carrying out this project \$197,500 was expended.

The existing project adopted June 3, 1896, is to secure a uniform channel 125 feet wide and 18 feet deep from the East River to the head of navigation at Metropolitan avenue, at an estimated cost of \$450,000. This estimate was subsequently reduced to \$213,000.

The amount expended in carrying out this project up to the close of the fiscal year ending June 30, 1903, was \$198,049.39.

This expenditure has resulted in a practical completion of the project, as a channel of the proposed dimensions has been secured.

The maximum draft that could be carried June 30, 1903, at mean low water was 18 feet. The range of tide is about 4½ feet.

The quantity of freight handled amounts to probably 3,000,000 tons annually, and consists mainly of coal, building materials, oil, and chemicals.

Dredging for maintenance will be necessary from time to time.

July 1, 1902, balance unexpended	\$15,285.61
June 30, 1903, amount expended during fiscal year	335.00

July 1, 1903, balance unexpended	14,950.61
--	-----------

(See Appendix F 9.)

10. *Browns Creek, New York.*—This is a narrow stream which empties into Great South Bay, Long Island, near Browns Point. It had originally a depth of from 1 to 3 feet at low water, a bar at the mouth having less than 1 foot.

The project for improvement, approved September 19, 1890, provides for a channel 100 feet wide and 4 feet deep, to extend from deep water in the bay up to Sayville highway bridge, and to be protected at the entrance by jetties on both sides. Estimated cost, \$46,000.

Up to June 30, 1903, there had been expended on this improvement \$28,000, of which \$3,000 was for maintenance.

The west jetty is 492 feet long and the east jetty 438 feet long, both with top width of 3 feet at 1 foot above high water and both partly covered at the shore end by accretion. They are in bad condition. The dredged channel is 3,200 feet long, with a depth of from 4 to 8 feet at mean low water and width of 100 feet. Shoaling has taken place at end of jetties.

No work was in progress during the past year.

The maximum draft that could be carried over the shoalest part at mean low water on June 30, 1903, was 4 feet, except at mouth, where considerable shoaling is reported. Mean range of tides, 1 foot.

Great benefit has resulted from the improvement to the fishing people in this locality. Two new oyster houses have been established in the past year.

The commerce consists mainly of coal, building materials, and fish, and amounted to 10,700 tons in 1898, 11,642 tons in 1899, 12,272 tons in 1900, 17,025 tons in 1901, and 17,630 tons in 1902.

Details in reference to this work appear in Report of the Chief of Engineers for 1897, page 1111. A sketch of the creek is printed in Report of the Chief of Engineers for 1894, page 710.

July 1, 1902, balance unexpended	\$372. 98
June 30, 1903, amount expended during fiscal year	372. 98

{	Amount (estimated) required for completion of existing project	18,000. 00
	Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance	10,000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F 10.)

11. *Great South Bay, New York.*—The first project, approved September 19, 1890, provided for the improvement of the Patchogue River, a small inlet extending from Great South Bay, Long Island, to the village of Patchogue. This stream had before improvement a depth of 2 feet. The project provided for a channel about 5,000 feet long, 60 feet wide, and 6 feet deep, to be protected at its mouth against westerly storms by a jetty 1,700 feet long. Estimated cost, \$40,000.

On June 30, 1902, there had been spent on this work \$40,000, and the project was completed.

The present project, approved June 13, 1902, provides for dredging a channel from Fire Island inlet, which connects Great South Bay with the ocean, to Patchogue, on Patchogue River. From the inlet to the central basin in Great South Bay the channel is to be 10 feet deep at mean low water and 200 feet wide. From the central basin to Patchogue the channel is to be 8 feet deep and 100 feet wide at mean low water. Estimated cost, \$66,000 and \$2,000 annually for maintenance.

There had been expended in carrying on this work on June 30, 1903, \$47,921.97.

The maximum draft that could be carried June 30, 1903, over the shoalest part of the channel was 6 feet. Mean range of tides, 1 foot.

The commerce consists mainly of coal, lumber, and fish. It amounted to 255,200 tons in 1898, to 266,800 tons in 1899, to 274,100 tons in 1900, to 281,300 tons in 1901, and to 257,500 tons in 1902.

For details as to improvement, see Patchogue River, Reports of the Chief of Engineers, for 1897, page 1108, and 1901, page 1249.

A sketch is printed in Report of the Chief of Engineers for 1893, page 984, and also in this report.

July 1, 1902, balance unexpended	\$66,000.00
June 30, 1903, amount expended during fiscal year	7,921.97
July 1, 1903, balance unexpended	58,078.03
July 1, 1903, outstanding liabilities	4,557.89
July 1, 1903, balance available	53,520.14
July 1, 1903, amount covered by uncompleted contracts	49,548.04
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
2,000.00	

(See Appendix F 11.)

12. *Hudson River, New York.*—The portion of this river which is now under improvement is the stretch beginning at the State dam at Troy and extending downstream to Coxsackie, a distance of 28 miles. In its natural condition the channel was narrow and crooked, with a navigable depth of 4 feet between the State dam and Albany, of 7½ feet between Albany and New Baltimore, of 11 feet between New Baltimore and Coxsackie, and of 12 feet or more below Coxsackie.

The original project for improvement, adopted in 1834, modified in 1852, and again in 1866, had for its object the securing of a navigable channel of sufficient width and 9 feet deep between Troy and Albany, and 11 feet deep between Albany and New Baltimore. In carrying out this work \$1,667,938 was expended.

The existing project, approved July 13, 1892, and amended March 3, 1899, provides for a 12-foot channel 150 feet wide from the State dam to the foot of Jacob street, Troy; thence gradually increasing in width to 400 feet at the foot of Broadway, Troy; thence 400 feet wide to Coxsackie. This work was estimated to cost \$4,343,863.

The amount expended on the work under this project to the close of the fiscal year ending June 30, 1903, was \$2,979,598.70, of which \$189,854 was applied to maintenance of improvement.

The results of the above expenditure have been to provide a channel generally 11 feet deep, nowhere less than 40 feet wide, and in some places 400 feet wide, from Coxsackie to the Delaware and Hudson Company's bridge at Troy, and 10 feet deep and 60 feet wide to within about 1,200 feet of the State dam, but ice gorges which formed during the winters of 1902 and 1903, together with the movement of lighter material which the dredging had exposed to the action of the strong current of the upper portion of the river, have caused a shoaling at several localities, notably between Roah Hook and North Coeymans and at Bath shoal, where the depth was not more than 9½ and 9 feet, respectively, until the depth on the latter was increased to 11 feet by dredging a channel 40 feet wide for the relief of navigation.

The maximum draft that could be carried June 30, 1903, at mean low water, was 5½ feet from the State dam to Rensselaer street; thence 10 feet to and through the fixed span of the Delaware and Hudson Company's bridge, and 4½ feet through the drawspan; thence to North Coeymans 11 feet; thence to Roah Hook 9½ feet, and thence to Coxsackie 11 feet.

The range of tides varies from 1.61 feet at the State dam, and 2.75 feet at Troy and Albany, to 3.69 feet at Cossackie.

The commerce within the limits of the improvements now in progress, amounting to 5,070,800 tons in 1899, 4,810,927 tons in 1900, 3,123,409 tons in 1901, and 3,673,097 tons in 1902, consists principally of grain, fuel, lumber, building material, and ice.

To complete this improvement to the best advantage contracts should be authorized in advance of appropriations for the remainder of the work.

The river and harbor act approved June 13, 1902, authorized the Secretary of War to appoint a Board of Engineers to examine and determine whether existing Government work in connection with the upper Hudson improvement causes gorges and freshets between Albany and Cossackie; to report what changes should be made, if any, provided such is the case, together with an estimate of the cost thereof. It is expected that the Board's report will be ready for submission to Congress in December, 1903.

July 1, 1902, balance unexpended	\$491, 449. 55
June 30, 1903, amount expended during fiscal year	167, 541. 69
July 1, 1903, balance unexpended	323, 907. 86
July 1, 1903, outstanding liabilities	62, 207. 06
July 1, 1903, balance available	261, 700. 80
July 1, 1903, amount covered by uncompleted contracts	200, 402. 89
{ Amount (estimated) required for completion of existing project	1, 040, 356. 44
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	300, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F 12.)

13. *Saugerties Harbor, New York.*—This harbor, situated within the mouth of Esopus Creek, which empties into the Hudson River on its west shore about 100 miles above New York City, is navigable for a distance of about three-fourths of a mile. In its natural state the creek had a depth of 7 feet; the entrance, however, was obstructed by a wide shoal, on which there was a depth of but 3 feet.

The original project for improvement, adopted in 1884 and modified in 1887, was to secure a permanent channel 200 feet wide and 8 feet deep, at an estimated cost of \$52,000. This project, completed in 1892, involved an expenditure of \$42,000, and \$15,000 had been expended for maintenance to June 30, 1902.

The existing project, adopted June 13, 1902, provides for a channel 12 feet deep and 200 feet wide from the Hudson River to the steamboat landing at Saugerties, at an estimated cost of \$44,685, with an annual expenditure of \$2,500 for maintenance.

Under this project \$4,080.72 was expended up to the close of the fiscal year ending June 30, 1903, \$3,000 of which was expended under an emergency contract for redredging the channel, which had shoaled during the freshets of last fall.

This channel has been referred to in previous reports and projects as 300 feet wide, which is an error. The distance between the parallel dikes varies from 260 to 290 feet, and the dredged channel is nowhere more than 200 feet wide.

The maximum draft that could be carried June 30, 1903, at mean low water was 9 feet. The mean rise and fall of the tide is about 4 feet.

The commerce consists mainly of bluestone, coal, building materials, and general merchandise, and amounted to 76,673 tons in 1900, to 67,473 tons in 1901, and to 66,500 tons in 1902.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	4,080.72

July 1, 1903, balance unexpended	15,919.28
--	-----------

July 1, 1903, amount covered by uncompleted contracts	8,000.00
---	----------

{ Amount (estimated) required for completion of existing project	24,685.00
--	-----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	25,000.00
--	-----------

{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
--	--

(See Appendix F 13.)

14. *Harbors at Rondout and Peekskill, N. Y.*—(a) *Rondout Harbor*.—This harbor is situated at the mouth of Rondout Creek, which is navigable to Eddyville, a distance of 3 miles from the head of the harbor. The creek empties into the Hudson River on its west shore 90 miles above New York City, and was the eastern terminus of the Delaware and Hudson Canal until that waterway was abandoned several years ago.

In 1871, when the harbor was surveyed, an available depth of 7 feet was found, the result of improvement made by private parties.

The last project for improvement, approved June 10, 1872, provided for a permanent channel 14 feet deep and 100 feet wide, the cost of which was estimated at \$172,500, and was completed in 1880 at a cost of \$90,000.

The amount expended on the work up to the close of the fiscal year ending June 30, 1903, is \$119,525.62, of which \$29,525.62 was applied to maintenance. There now exists a channel 14 feet deep and 30 feet wide.

The maximum draft which can be carried June 30, 1903, is 14 feet at mean low water. The mean rise and fall of tide is 4 feet.

The commerce is mainly in fuel, bluestone, cements, and general merchandise, and amounted to 1,885,000 tons in 1900, to 1,485,000 tons in 1901, and to 1,285,000 tons in 1902.

No additional work, except for maintenance, is necessary.

(b) *Peekskill Harbor*.—This harbor is on the eastern shore of the Hudson River, about 45 miles above New York City, and has an area of about 1 square mile. Navigation was obstructed by a flat 3,500 feet wide from the wharves to the 12-foot contour of the river channel, over which the maximum depth was 5 feet at mean low water. A narrow channel 6 feet deep followed the shore line from north to south past the village wharves, which enabled steamboats and small craft to come and go with freights.

The original and existing project for improvement, approved June 3, 1896, provided for a dredged channel 100 feet wide and 10 feet deep from deep water in the Hudson River north of the village to deep water south of it, following generally the contour of the shore of the harbor. The estimated cost of the improvement was \$50,000.

The amount expended to the close of the fiscal year ending June 30, 1903, is \$19,400, none of which has been applied to maintenance. This expenditure resulted in the completion of a channel of the proposed dimensions.

The maximum draft that can be carried to the wharves on June 30, 1903, is 9.5 feet at mean low water. The range of the tides is about 4 feet.

The commerce, consisting of general merchandise, building material, iron ore and products, coal, lumber, and molding sand, amounted to 1,800,750 tons in 1900. No statistics were furnished in 1901, and so far as reported, 22,815 tons in 1902.

July 1, 1902, balance unexpended	\$6, 100. 00
June 30, 1903, amount expended during fiscal year	525. 62
July 1, 1903, balance unexpended	5, 574. 38
July 1, 1903, outstanding liabilities	74. 76
July 1, 1903, balance available	5, 499. 62

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F 14.)

15. *Wappinger Creek, New York.*—Wappinger Creek, a small stream which empties into the Hudson River on the left bank one-half mile below the village of New Hamburg, N. Y., is navigable from the mouth to Wappinger Falls, a distance of about 2 miles. The natural depth in the channel did not exceed 6 feet, while the width varied from 25 to 75 feet.

The original project for improvement, adopted September 19, 1890, contemplated making a channel 80 feet wide and 8 feet deep, at mean low water, from the mouth to the falls, at an estimated cost of \$13,000.

The amount expended on this improvement to June 30, 1903, was \$13,012, \$12 of which was applied to maintenance.

This expenditure resulted in a channel of the contemplated dimensions; also an extension 40 feet wide and 8 feet deep, at mean low water, from deep water in the main branch of the creek to the Wappinger town dock. These channels were completed June 30, 1892, since which time no work has been done.

The maximum draft that can be carried June 30, 1903, at mean low water, from the mouth to the falls is believed to be 6 feet. The range of tides at the mouth is about 4 feet.

The commerce, consisting principally of cotton goods, clothing, combs, and iron, amounted to 70,000 tons in 1888, since which time no statistics have been compiled.

No additional work, except for maintenance, is necessary.

July 1, 1902, balance unexpended	\$1, 500. 00
June 30, 1903, amount expended during fiscal year	12. 00
July 1, 1903, balance unexpended	1, 488. 00

(See Appendix F 15.)

16. *Removing sunken vessels or craft obstructing or endangering navigation.*—(a) *Wreck of coal barge B. L. Collar in Bronx River,*

New York.—This wreck was sunk in the Bronx River, near the head of navigation, in such a manner as to almost block the channel. It was reported on June 21, estimate submitted for its removal, and allotment made by the Department on June 25, 1902. It was removed August 2, 1902, at a cost of \$175.

(b) *Wreck of canal boat Alert in Hudson River, near Hoboken, N. J.*—This was a derelict found floating in the Hudson River. It was reported to the Department July 23, an allotment of \$175 made July 28, and the wreck removed August 1, 1902.

(c) *Wreck of sloop Pell in East River, New York.*—This sloop was sunk in the East River off Pier 7, Brooklyn, in about 42 feet of water, its mast appearing above water at low tide, and constituting a dangerous obstruction to navigation. It was reported December 17, an allotment made December 20, 1902, and the mast and rigging removed January 24, 1903, at a cost of \$100. The hull was left at the bottom of the river in from 42 to 48 feet of water.

(d) *Wreck of barge Bertha Miner in the Bronx River, New York.*—This barge, loaded with coal, was sunk in the Bronx River, near the foot of One hundred and seventy-seventh street, New York City, on February 27, 1903. It was reported to the Department April 10, an allotment of \$248 made April 17, and the wreck completely removed for this sum on May 4, 1903.

(e) *Unknown wreck in Hudson River, near North Coeymans, N. Y.*—This was a wreck of an unknown canal boat, found in the Hudson River about 11 miles below Albany, N. Y., March 13, 1903. It was reported to the Department April 17, an allotment of \$170 made for its removal April 22, and it was completely removed May 27, 1903.

(f) *Wreck of the barge Jas. Cogswell in the Hudson River at Albany, N. Y.*—This barge, loaded with coal, sunk at the foot of Madison street, Albany, N. Y., on November 11, 1902. Proposals were invited for its removal December 17, and reported to the Department December 29, 1902. Authority was given to accept the lowest bid, \$500, on December 31, 1902, and an allotment made for that purpose. Order was given for its removal January 26, 1903, but owing to continued high water in the Hudson River the wreck was not completely removed until May 28, 1903. The total cost was \$500.

(See Appendix F 16.)

IMPROVEMENT OF NEW YORK HARBOR, OF BAY RIDGE, RED HOOK AND BUTTERMILK CHANNELS, AND OF GOWANUS CREEK CHANNEL, NEW YORK; ENLARGEMENT OF GOVERNORS ISLAND.

This district was in the charge of Maj. W. L. Marshall, Corps of Engineers, having under his immediate orders Lieut. William L. Guthrie, Corps of Engineers, to September 28, 1902. Division Engineer, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, United States Army, retired), to February 25, 1903. and Col. Amos Stickney, Corps of Engineers, since that date.

1. *New York Harbor, New York.*—Before the improvement of the main entrance into New York Harbor was undertaken by the United States the least depth in mid-channel on the outer bar was 23.7 feet at mean low water and about the same across three other shoals between the bar and deep water in the harbor. A large proportion of the commerce of the port, carried in vessels of great draft, could cross these shoals only at or near high water.

The project for the improvement of Gedney channel was approved by the Secretary of War December, 1884, and extended to cover the

whole of the main entrance to the harbor December, 1886. It provided for dredging a channel 1,000 feet wide and 30 feet deep at mean low water from deep water below the Narrows through the Main Ship and Gedney channels to deep water outside the bar. The estimated cost was \$1,490,000 for dredging 4,300,000 cubic yards. The actual amount dredged to October, 1891, when the work was approximately completed, was 4,875,079 cubic yards.

The existing project for maintenance of channels was approved November 15, 1892. The estimated cost of this work varies in different years; it is estimated at \$50,000 annually.

Under these projects the amount expended up to July 1, 1903, is \$1,939,757.63.

As a result of these expenditures channels to the sea have been produced and maintained with a navigable depth of 30 feet at mean low water and with width of 1,000 feet.

June 30, 1903, the channels are navigable at mean low water by ships drawing 30 feet. The mean rise of tide is $4\frac{1}{2}$ feet.

Under the terms of the river and harbor act of 1899 a project was adopted for making an entrance to New York Harbor by way of Ambrose channel (formerly known as East channel), to be 2,000 feet wide and 40 feet deep at mean low water; the work was authorized to be done under a continuing contract at a cost not exceeding \$4,000,000. It involves excavation of a channel about 7 miles in length.

The original depth through this channel was 16 feet at mean low water, the shoalest part being the outer bar. The channel was used only by towboats, scows, and other light-draft vessels.

Under the existing project up to July 1, 1903, \$704,098.59 has been expended in excavating for about $1\frac{1}{2}$ miles in length on the outer bar; 8,995,620 cubic yards of material has been removed and the channel has been excavated to widths of from 500 to 2,000 feet, the depths made being from 30 to 40 feet or over.

No result useful to navigation will be obtained until the cuts are carried through the outer bar, which is about 2 miles across; the available depth of the channel June 30, 1903, is limited by the part of the bar not yet dredged and is about 16 feet at mean low water.

By joint resolution of Congress, approved July 1, 1902, the removal of a reef in North River, off Pier A, was authorized, the depth to be made 40 feet at mean low water; the cost was limited to \$25,000, to be paid from the appropriation for improving Ambrose channel. It has not been possible to get the work under contract within the limits of authorized cost.

The sundry civil act of March 3, 1903, appropriated \$733,000 for continuing the improvement of Ambrose channel. The contractor is far behind the rate of progress required in this contract, and the sum is more than he can earn during the year which the appropriation is designed to provide for. It is therefore proposed to build two dredges in order to hasten the progress and to secure to navigation the benefit of this important improvement at as early a date as possible. Details regarding dredge construction are given herewith in Appendix I 6.

The foreign exports and imports for the port of New York during the year ending June 30, 1901, amounted approximately to 9,960,000 tons, valued at \$1,145,029,311, being an increase over the valuation in 1886, before the improvement was begun, of \$304,752,619. The entire cost of improvement of New York Harbor up to date is less than 1 per cent of the increase in annual value of foreign commerce of the

port since the improvement began, and is less than one-quarter of 1 per cent of the value of the present foreign commerce per year.

No statistics are kept of the local and coastwise domestic commerce.

Further details of the harbor and improvements are printed in the Annual Report of the Chief of Engineers for 1897, page 1031.

A report on survey of Ambrose (East) channel, with map, is printed in House Document No. 243, Fifty-fourth Congress, second session. (See Annual Report of the Chief of Engineers for 1897, p. 1053.)

In connection with the established harbor lines along the water front of Staten Island and the westerly shore of Arthur Kill, New York, it is deemed essential that stone monuments be provided to establish the base lines from which the pierhead and bulkhead lines are determined. The estimated cost of such monuments is \$5,000, and it is recommended that this amount be provided for the purpose in appropriating for maintenance of New York Harbor.

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$52, 113. 36
June 30, 1903, amount expended during fiscal year	18, 846. 47
July 1, 1903, balance unexpended	33, 266. 89
July 1, 1903, outstanding liabilities	175. 00
July 1, 1903, balance available	33, 091. 89
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	75, 000. 00

AMBROSE CHANNEL.

July 1, 1902, balance unexpended	\$876, 563. 62
Amount appropriated by sundry civil act approved March 3, 1903	733, 000. 00
June 30, 1903, amount expended during fiscal year	1, 609, 563. 62
July 1, 1903, balance unexpended	a 300, 662. 21
July 1, 1903, balance unexpended	1, 308, 901. 41
Amount diverted by joint resolution approved July 1, 1902, for removal of obstruction in North River	25, 000. 00
July 1, 1903, outstanding liabilities	1, 283, 901. 41
July 1, 1903, balance available	b 225, 560. 17
July 1, 1903, balance available	1, 058, 341. 24
July 1, 1903, amount covered by uncompleted contracts	3, 015, 396. 00
Amount (estimated) required for completion of existing project	1, 987, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	600, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

REMOVAL OF OBSTRUCTION IN NORTH RIVER.

Amount diverted from appropriation for Ambrose channel, sundry civil act June 28, 1902, joint resolution approved July 1, 1902	\$25, 000. 00
June 30, 1903, amount expended during fiscal year	549. 75
July 1, 1903, balance unexpended	24, 450. 25

(See Appendix G 1.)

^a Includes \$2,145.61 on account of construction of dredge.

^b Includes \$171.10 on account of construction of dredge.

2. *Channel in Gowanus Bay: Bay Ridge and Red Hook channels, New York Harbor.*—These channels lie along the east shore of the upper bay, New York Harbor, and with Buttermilk channel form an easterly channel between the Narrows and East River, separated from the main channel by a broad shoal off Gowanus Bay and by Governors Island.

Bay Ridge and Red Hook channels had a natural low-water depth of 7 to 12 feet, and were available only for a limited harbor commerce.

The original project, adopted in 1881, provided for making these channels 18 feet deep and 200 feet wide, subsequently modified to make the depth 26 feet with width of 800 feet in Bay Ridge channel and 400 feet in Red Hook channel. This was completed in 1899 at a cost of about \$1,090,000.

The existing project was adopted by the terms of the river and harbor act of 1899, which provided for making Bay Ridge and Red Hook channels 40 feet deep at mean low water and 1,200 feet wide. The work was authorized to be done under a continuing contract at a cost not exceeding \$2,500,000.

Under this project, up to July 1, 1903, \$377,220.70 has been expended. About 30 per cent of the entire area to be dredged has been excavated to depths ranging from 28 to 40 feet, and about one-fifth the amount of excavation required by the contract has been made. In its present state of progress the work is not far enough advanced to be of any general benefit to the channels as a whole, and the maximum available depth throughout their entire length on June 30, 1903, was 26 feet at mean low water; the depths to the wharves along the South Brooklyn water front are 30 feet or over.

The mean rise of tide is 4.5 feet.

The commerce of this part of New York Harbor consists of coal, lumber, iron, cotton, and miscellaneous freight amounting in 1902 to (as nearly as can be determined) 5,200,000 tons, and valued at \$165,000,000. It is increasing.

The additional work authorized under the existing continuing contract is necessary to get the benefit of the work already done.

Further details concerning these channels are contained in the Annual Report of the Chief of Engineers for 1899, page 1266.

House Document No. 337, Fifty-fourth Congress, second session, contains a report upon a survey of these channels, with map showing locations and depths as existing in 1897 (see Annual Report of the Chief of Engineers for 1897, p. 1177).

July 1, 1902, balance unexpended	\$416, 276. 48
Amount appropriated by sundry civil act approved March 3, 1903.....	272, 000. 00
	688, 276. 48
June 30, 1903, amount expended during fiscal year.....	191, 497. 18
July 1, 1903, balance unexpended	496, 779. 30
July 1, 1903, outstanding liabilities	111, 452. 58
July 1, 1903, balance available.....	385, 326. 72
July 1, 1903, amount covered by uncompleted contracts.....	1, 710, 292. 10
{ Amount (estimated) required for completion of existing project.....	1, 626, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance available July 1, 1903.....	226, 000. 00
{ Submitted in compliance with requirements of sundry civil act of	
June 4, 1897.....	

(See Appendix G 2.)

3. *Buttermilk channel, New York Harbor.*—This channel, lying between Governors Island and the Brooklyn shore, forms an easterly channel from East River to the main channel and to Red Hook channel.

Prior to improvement it had a natural depth of 26 feet in a channel so narrow and crooked as to be hardly navigable. Its available depth for navigation was about 20 feet.

The first project for improvement, adopted in 1850, provided for the removal of part of one shoal to widen the channel. This was subsequently extended to removal of both shoals to 26 feet depth, making the channel about 1,000 feet wide. The work was completed in 1899, at a cost of about \$650,000.

The existing project, adopted by the river and harbor act of 1902, provides for deepening the channel to 30 feet at mean low water, with such width as the appropriation of \$90,000 will suffice for, estimated at about 400 feet.

A contract for dredging has been entered into, under which work will be begun early in the ensuing year.

The available depth in this channel is 26 feet at mean low water, and the mean rise of tide is 4.5 feet.

The commerce of Buttermilk channel in 1899 amounted to 16,587,000 tons, valued at \$658,384,823. It is believed to be about the same now as then.

The work proposed under the existing project is to increase the available depth to 30 feet at mean low water by deepening the eastern side of the channel. This project will be completed under the existing contract.

A survey of Buttermilk channel was made in 1900. The report containing further details is printed, with map, in House Document No. 122, Fifty-sixth Congress, second session. (See Annual Report of the Chief of Engineers for 1901, p. 1299.)

July 1, 1902, balance unexpended	\$90,000.00
June 30, 1903, amount expended during fiscal year	97.41
July 1, 1903, balance unexpended	89,902.59
July 1, 1903, amount covered by uncompleted contracts	80,000.00

(See Appendix G 3.)

4. *Gowanus Creek channel, New York Harbor.*—That part of Gowanus Creek improved under the title of Gowanus Creek channel is the part from the foot of Percival street on the east to the junction of Red Hook and Bay Ridge channels on the west.

Before improvement Gowanus Creek channel had an available low-water depth of 11 feet, which was sufficient at that time, because the channels of approach in Gowanus Bay had no greater depth.

The first project for improvement, adopted in 1881 and subsequently modified, provided for making a depth of 21 feet at mean low water in the Gowanus Creek channel, with width extending to the harbor lines on either side. This was accomplished in 1893 under parts of appropriations made for the several channels, of which it is estimated that about \$75,000 was applied to Gowanus Creek channel.

The existing project, adopted in 1896, provides for making the channel 26 feet deep at mean low water, at a total estimated cost of \$70,000.

Up to July 1, 1902, \$50,000 had been expended upon this project, and the channel had been made 26 feet deep at mean low water for its full length and nearly its full projected width. It had shoaled in places.

During the past fiscal year a contract for dredging to complete the project was entered into and work will be begun early the next year.

Up to July 1, 1903, \$39.49 has been expended under the present project.

The available depth of the channel June 30, 1903, is 26 feet at mean low water. The mean rise of tide is 4.5 feet.

The commerce received in Gowanus Creek consists of coal, lumber, building materials, and miscellaneous goods, amounting to about 237,300 tons of freight in 1899, valued at \$3,048,390. In addition, 2,041,980 tons of freight passed through Gowanus Creek channel to and from Gowanus Canal, valued at about \$20,000,000, making a total tonnage of 2,279,280 tons. The annual value of this commerce is about three hundred times the cost of the present project.

The additional work proposed, with available funds, will complete the project, extending the improvement to the full width of the channel and removing shoals.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	39.49
July 1, 1903, balance unexpended	19,960.51
July 1, 1903, amount covered by uncompleted contracts	18,000.00
(See Appendix G 4.)	

5. *Enlargement of Governors Island, New York Harbor.*—The project for this entire work, adopted under the terms of the sundry civil act of 1901, which made appropriations for beginning operations, included an addition of about 82 acres to the area of the island by inclosing with a bulkhead part of the shoal southwest of the island and filling the inclosure, the building of a wharf on the north shore and dredging to a depth of 26 feet in front of the wharf, and the erection of buildings. The work of enlargement, including construction of a wharf and dredging, all estimated to cost \$1,100,000, was assigned to the Engineer Department. By a modification of the project adopted in April, 1902, the enlargement was to be extended southwest over the shoal, to reclaim an additional area of about 19 acres, making the total area of the enlargement about 101 acres.

Work was begun in August, 1901, and up to June 30, 1903, \$186,148.25 had been expended.

During the past fiscal year 2,340 linear feet of riprap construction for the sea wall was completed; under a contract for building the embankment, 836,668 cubic yards of filling has been delivered; intercepting sewers have been built to provide an outlet for the sewers which have heretofore discharged into the area now being filled.

Up to July 1, 1903, 4,770 linear feet of sea-wall substructure has been built; a wharf with T head 370 feet long has been completed and the approaches have been dredged to 2 feet depth; intercepting sewers have been built; about 5 acres of the embankment have been built to above low-water level.

The available funds will be applied to completing the riprap, leaving a temporary opening for delivery of material for the fill, to continuing the filling, and to beginning construction of masonry sea wall on the substructure.

Future appropriations will be applied to continuing and completing the enlargement.

July 1, 1902, balance unexpended	\$290, 506. 01
Amount appropriated by sundry civil act approved March 3, 1903	150, 000. 00
June 30, 1903, amount expended during fiscal year	440, 506. 01
	76, 654. 26
July 1, 1903, balance unexpended	
	363, 851. 75
July 1, 1903, outstanding liabilities	42, 626. 09
July 1, 1903, balance available.....	321, 225. 66
July 1, 1903, amount covered by uncompleted contracts.....	180, 742. 65
{ Amount (estimated) required for completion of existing project	475, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1905, in addition to the balance available July 1, 1903.....	200, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4,	
{ 1897.	

(See Appendix G 5.)

6. *Removing sunken vessels or craft obstructing or endangering navigation.*—(a) The coal barges *Litchenfels Bros.*, *Ringleader*, and *P. J. Carleton* were partly removed at the beginning of the fiscal year. The removal was completed in September, 1902.

(b) The small schooner *John Comstock* sunk in Gowanus Creek in the dredged channel. It was removed and deposited behind the bulkhead line at Weehawken, N. J., where it lay aground at high tide.

(c) A section of a canal boat, about 60 feet long, grounded in 24 feet of water in front of the ferry landing at Tompkinsville. It was lifted and placed upon a dock. No marks were found by which it could be identified.

(d) The following wrecks and obstructions were removed by the U. S. S. *Manissee* without cost:

Broken spar buoy, with anchor and stone, off Southwest Spit; taken to the light-house station at Tompkinsville.

End of deck scow, found off Hoffman Island; grounded and cut up for firewood.

End of car float, found in Buttermilk channel; grounded and cut up.

The expenditure during the year amounted to \$19,892.

(See Appendix G 6.)

IMPROVEMENT OF RIVERS AND HARBORS IN NORTHEASTERN NEW JERSEY.

The works in this district were in the temporary charge of Capt. Spencer Cosby, Corps of Engineers, to August 20, 1902, and in the charge of Lieut. Col. G. W. Raymond, Corps of Engineers, since that date.

1. *Passaic River, New Jersey.*—This river is a stream of considerable size, rising among the highlands in the northern part of New Jersey and flowing in a general easterly and southerly course into Newark Bay. It is navigable from its mouth to Passaic, a distance of about 16 miles, where navigation is cut off by the Dundee Water Power and Land Company's dam. In its natural condition the navigable depth to Newark was about 7 feet at mean low water; from Newark to Passaic it was about 3 feet.

The first project for improvement, adopted by the river and harbor act of June 10, 1872, was for providing a channel from Newark to Passaic from 6 to 7½ feet deep and from 50 to 200 feet wide, the first

cost being estimated at \$123,924; this was subsequently increased to \$193,822.

A subsequent project for improving the river below Newark was authorized by the river and harbor act of June 14, 1880, at an estimated cost of \$353,875. It proposed a channel 200 feet wide and 10 feet deep at mean low water up to Center Street Bridge, Newark.

The two projects were consolidated by the river and harbor act of July 13, 1892, the estimated cost of the improvement being \$547,697.

The amount expended under this consolidated project up to the close of the fiscal year ending June 30, 1903, was \$470,056.45, of which \$391,241.45 was used in carrying out the projects and \$78,815 for maintenance.

By the enactment of the river and harbor law approved June 13, 1902, a new project was adopted for part of the river, as follows: "Improving Passaic River, New Jersey, in accordance with the report submitted in House Document No. 401, Fifty-sixth Congress, first session, from Staten Island Sound through Newark Bay and the said river to the Montclair and Greenwood Lake Railroad Bridge, with a channel 12 feet deep to the Nairn Linoleum Works, and 10 feet deep from that point to the said railroad bridge." Estimated cost, \$296,000, and the yearly cost of maintenance is estimated at \$5,000. The old project for improving the river below Newark is merged into this new project, and may be considered completed.

The adoption of this new project for the lower part of the river leaves in force the part of the old project above Newark, which is included between the Montclair and Greenwood Lake Railroad bridge and Passaic.

Up to June 30, 1903, \$173,734, including maintenance, had been expended on this part of the project, leaving approximately \$43,000, which includes the amount expended for maintenance, as the estimated cost of completion. The annual cost of maintenance is estimated as \$5,000.

During the past fiscal year the dredging required to complete the project adopted by the river and harbor act of June 13, 1902, was advertised twice, viz: January 17, bids received February 16, and March 23, bids received April 22, 1903. The lowest bid received in these proposals was 40 per cent in excess of the approved estimated cost of the work, therefore the commencement of the work was not authorized.

It is evident that the work can not be completed within the limit authorized for that purpose.

Under date of May 22, 1903, the Secretary of War authorized an allotment of \$10,000 for emergency dredging. Bids under public notice have been received twice, but the lowest bid received was 78 cents per cubic yard, and this price being excessive the work has not been commenced.

The maximum draft that could be carried June 30, 1903, was as follows: 95 feet to the Center Street Bridge, Newark; 7 feet to the Erie Railroad bridge, Newark, and 3 to 5 feet to Passaic. Mean range of tides: At mouth of river, 4.7 feet; at Passaic, 2.5 feet.

The commerce of this river is mainly in building material, iron ore, fertilizers, coal, and general merchandise, and amounted to 1,962,462 tons in 1899, to 2,037,363 tons in 1900, to 2,009,356 tons in 1901, and to 2,494,312 tons in 1902.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1896, pages 770 to 774, and for 1900, pages 177 and 1530 to 1550.

Maps showing mouth of river and Newark Bay are printed in Annual Reports of the Chief of Engineers for 1882, page 686, and for 1887, page 766, and maps of the river above the mouth are printed in House Document No. 401, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended.....	\$76, 000. 00
Amount appropriated by sundry civil act approved March 3, 1903	100, 000. 00
May 23, 1903, amount allotted from appropriation for emergencies in river and harbor works.....	10, 000. 00
	186, 000. 00

November 28, 1902, deposited to credit of Treasurer United States	\$1, 000. 00
June 30, 1903, amount expended during fiscal year.....	1, 706. 45
	2, 706. 45

July 1, 1903, balance unexpended	183, 293. 55
July 1, 1903, outstanding liabilities	1. 06

July 1, 1903, balance available.....	183, 292. 49
--------------------------------------	--------------------

Amount (estimated) required for completion of existing project.....	164, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement	\$100, 000. 00
For maintenance of improvement.....	10, 000. 00
	110, 000. 00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 189.9

(See Appendix H 1.)

2. *Arthur Kill, or Staten Island Sound, and channel between Staten Island and New Jersey.*—(a) *Arthur Kill, or Staten Island Sound, New York and New Jersey.*—This is a waterway about 12 miles long which, together with the lower end of Newark Bay, 2 miles long, and the Kill van Kull, 3 miles long, forms the inland waterway between upper new York Harbor and Raritan Bay. The section now contemplated under this improvement consists of the 14 miles of channel between Kill van Kull and Raritan Bay. The original depth through the Arthur Kill, or Staten Island Sound, at mean low water, was 15 feet and upward, in a channel 100 to 1,000 feet in width. Through the lower end of Newark Bay the navigable channel depth is about 14 feet at mean low water, the result of an improvement commenced in 1874 and continued up to the present time. It is proposed in the present project to abandon this channel and cut through the flats to the southward, where the depth is about one foot at mean low water. Prior to the adoption of the present project, sections of this waterway were under improvement by the United States under the titles of "Channel between Staten Island and New Jersey" and "Arthur Kill." The former provided for a depth of 14 feet and width of 400 feet through the lower part of Newark Bay, and the latter for the removal of "Steep Point," in order to straighten the channel to the southwestward of the Baltimore and Ohio Railroad bridge.

Details as to these projects are printed in the Annual Report of the Chief of Engineers for 1895, pages 969 to 972, and in current report under the head of "Channel between Staten Island and New Jersey," which project is still in force.

The existing project for this improvement adopted by the river and harbor act approved June 13, 1902, provides for making and maintaining a channel from Kill van Kull to Raritan Bay, New York and New Jersey, by means of dredging and diking 300 feet wide and 21 feet deep at mean low water, at an estimated cost of \$696,000, and \$5,000 for annual cost of maintenance, in accordance with report submitted in House Document No. 393, Fifty-sixth Congress, first session, which is also printed in Annual Report of the Chief of Engineers for 1900, pages 1525 to 1530.

The amount expended to June 30, 1903, was \$2,291.16.

The operations during the past fiscal year were confined to making surveys and preparing maps and reports in the matter of location of channel at Shooters Island, pursuant to the provisions of the river and harbor act which adopted the project.

The maximum draft that could be carried through the waterway June 30, 1903, was about 14 feet at mean low water. Mean range of tides, 5 feet.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons; in 1900 to 11,047,633 tons; in 1901 to 11,651,300 tons, and in 1902 to 14,517,079 tons.

Maps of this work are printed in House Document No. 393, Fifty-sixth Congress, first session.

(b) *Channel between Staten Island and New Jersey.*—This channel is an inland waterway, about 17 miles long, connecting New York Harbor with Raritan Bay. It consists of the Kill van Kull, connecting the upper bay with Newark Bay, and the Arthur Kill, connecting Newark Bay with Raritan Bay.

The natural depth through the channel was 15 feet or more, except for a distance of about $1\frac{1}{4}$ miles in Newark Bay, where there was a shoal with a crooked channel $9\frac{1}{2}$ feet deep, bordered by flats with depth of about 2 feet of water. The improvement of the "Channel between Staten Island and New Jersey" consists in the deepening of the channel across this shoal.

The first project, adopted by the river and harbor act of June 23, 1874, was for making this channel from 14 to 16 feet deep, at an estimated cost of \$443,211. The only work done under it was the building of 2,237 linear feet of diking, at a cost of \$50,000.

The second and existing project was adopted in 1880, which, with subsequent modifications, proposed to dredge through the shoal a channel 400 feet wide and 14 feet deep at mean low water, the cost being estimated at \$210,000.

A supplemental project was adopted by the river and harbor act of August 11, 1888, which had for its object the removal of the point of land known as Steep Point for the straightening of the channel to the westward of the Baltimore and Ohio Railroad bridge. This work was carried on under the title of "Improvement of Arthur Kill, New York and New Jersey," 1888 to 1895. The cost was estimated at \$26,500, and the work was completed in 1895, at a cost of \$25,401.30. This modification of the project brought the total cost of the improvement up to \$286,500.

The river and harbor acts of June 3, 1896, and June 13, 1902, each allotted \$5,000 from appropriations made therein for this work,

to be expended in the dredging of a channel in Lemon Creek, on Staten Island. This extension increased the total estimated cost of the improvement from the beginning to \$296,500. Annual maintenance is estimated at \$10,000.

The total amount expended to June 30, 1903, on the project, with its additions and modifications, was \$290,421.45, which was applied to diking, to dredging a channel 14 feet deep and 400 feet wide through the shoal in Newark Bay, to removing Steep Point, and to dredging a channel in Lemon Creek 8 feet deep at high water and from 35 to 50 feet wide.

During the fiscal year, under appropriation of June 13, 1902, work has been done under a contract for dredging in Lemon Creek. This work was in progress at the close of the year.

The maximum draft that could be carried June 30, 1903, through the Staten Island channel was about 14 feet at mean low water. Mean range of tides, 5 feet.

The freight carried through this waterway consists of oil, coal, ores, clay products, chemicals, fertilizers, grain, machinery, manufactures, and general merchandise, and amounted in 1899 to 11,311,991 tons, in 1900 to 11,047,633 tons, in 1901 to 11,651,300 tons, and in 1902 to 16,266,574 tons.

Further details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1895, pages 969-970; for 1896, page 775. Maps of this improvement are printed in Annual Reports of the Chief of Engineers for 1881, page 696, and for 1889, pages 820-822, and in House Document No. 393, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended	\$111, 850. 88
Amount appropriated by sundry civil act approved March 3, 1903	150, 000. 00
	261, 850. 88
June 30, 1903, amount expended during fiscal year	3, 063. 49
July 1, 1903, balance unexpended	258, 787. 39
July 1, 1903, outstanding liabilities	124. 95
July 1, 1903, balance available	258, 662. 44
July 1, 1903, amount covered by uncompleted contracts	4, 177. 00
{ Amount (estimated) required for completion of existing project	446, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement	\$100, 000. 00
For maintenance of improvement	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	120, 000. 00

(See Appendix H 2.)

3. *Woodbridge Creek, New Jersey.*—This creek is a small crooked tidal creek about 5 miles long, running through flat marshes for most of its length, and emptying into the west side of Arthur Kill, or Staten Island Sound, 2 miles north of Perth Amboy, N. J.

It is navigable for 2½ miles above the mouth to a point where it is crossed by a highway bridge without a draw; the width of the creek below this bridge is about 100 feet. In its original condition this stream was obstructed at its mouth by a bar having a least depth of

9.8 feet at high water, and by two shoals just inside the mouth; from these shoals a good 12-foot channel existed to above Anderson's brick works, seven-eighths of a mile from the mouth, above which point, however, many shoals occurred, although a narrow 8-foot channel existed as far as Salamander dock, $1\frac{1}{4}$ miles from the mouth.

A survey of the navigable part of this creek was made in 1878, report upon which was printed in Annual Report of the Chief of Engineers, page 478, and a project for its improvement was adopted by the river and harbor act of March 3, 1879. This project provided for forming a channel 12 feet deep at mean high water and 80 feet wide from the mouth of the creek to the Salamander dock, at an estimated cost of \$13,800, which amount was increased in 1884 to \$29,000. Work on this improvement was carried on under appropriations made from 1879 to 1882, amounting to \$19,000, which was expended without completing the project and was suspended in 1883.

The present project adopted by the river and harbor act of June 13, 1902, contemplates obtaining a channel 8 feet deep at mean low water, with a bottom width of 50 feet, by dredging, from Arthur Kill to Salamander dock, at an estimated cost of \$35,000. It is estimated that \$3,000 will be required annually for maintenance. This project is printed in House Document No. 282, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 1552.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, was \$9,948.95. During the past fiscal year 45,066 cubic yards of material was dredged from the upper part of the creek, restoring the channel to project dimensions for a length of about 2,850 feet. The maximum draft that could be carried June 30, 1903, over the shoalest part of the channel was 6 feet at mean low water. The mean range of tides is 5 feet. The commerce of this creek, mainly in clay, brick, tile, coal, and building materials, amounted in 1887 to 126,000 tons, in 1898 to 176,000 tons, and in 1902 to 134,377 tons.

Detailed description of this work may be found in the Annual Report of the Chief of Engineers for 1900, pages 1552 to 1555. Map is printed in House Document No. 282, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended	\$10,000. 00
June 30, 1903, amount expended during fiscal year	9,948. 95
July 1, 1903, balance unexpended	51. 05
July 1, 1903, outstanding liabilities	22. 70
July 1, 1903, balance available	28. 35
{ Amount (estimated) required for completion of existing project	25,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	10,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H 3.)

4. *Raritan Bay, New Jersey.*—This bay is a large body of water lying between the southern end of Staten Island and the New Jersey shore. Its greatest width north and south is about 5 miles, and its greatest length east and west is about 7 miles. The Raritan River

empties into it at its west end between Perth Amboy and South Amboy, and the Arthur Kill, or Staten Island Sound, extends northward, connecting it with Newark Bay.

This bay had naturally a fairly straight channel 11 feet deep to South Amboy. The line of the deepest water, however, followed the Staten Island shore from Perth Amboy to Seguine Point, where it was separated from deep water in the eastern part of the bay by a shoal 1.5 miles broad with a minimum depth of 14.5 feet.

The existing project, approved March 3, 1881, and extended September 19, 1890, and June 3, 1896, provides for dredging channels 300 feet wide and 21 feet deep from Seguine Point to deep water in the bay, through two shoals opposite Wards Point, and from South Amboy to deep water near Great Beds light. The estimated cost of the work is \$507,875. Report on surveys with estimates is printed in Annual Reports of Chief of Engineers for 1881, page 717, and 1895, page 1015, and revised estimate in Report for 1891, page 932.

The amount expended on the work up to the close of the fiscal year ending June 30, 1903, was \$451,954.20, of which \$297,314.45 was used in carrying out the project and \$154,639.75 for maintenance.

During the fiscal year, under appropriation of June 13, 1902, 95,544 cubic yards of material was removed from the South Amboy channel under a contract for maintenance. Work was commenced on April 29, 1903, and was in progress at the close of the year.

Report of the examination authorized by the river and harbor act, approved June 13, 1902, will be submitted to Congress in December, 1903.

The maximum draft that could be carried June 30, 1903, through the Wards Point channel was 19.5 feet, and through the Seguine Point and South Amboy channels 19 feet, all at mean low water. Mean range of tides, 5 feet.

The commerce of the bay is mainly in coal, brick, manufactures, and general merchandise, and amounted in 1899 to 6,507,402 tons; in 1900 to 6,537,977 tons; in 1901 to 4,722,048 tons, and in 1902 to 5,453,122 tons.

For details of this improvement see Annual Report of the Chief of Engineers for 1896, pages 787-789.

July 1, 1902, balance unexpended	\$45,930.00
June 30, 1903, amount expended during fiscal year	10,384.20
July 1, 1903, balance unexpended	35,545.80
July 1, 1903, outstanding liabilities	7,785.21
July 1, 1903, balance available	27,760.59
July 1, 1903, amount covered by uncompleted contracts	24,712.96
{ Amount (estimated) required for completion of existing project	164,630.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance, available July 1, 1903	40,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H 4.)

5. *Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey.*—(a) *Keyport Harbor.*—This harbor is situated at the mouth of Matawan Creek,

on the south side of Raritan Bay, 5 miles east of the mouth of Raritan River, and it consists of a bay about 1 mile broad.

There was no distinct natural channel in the harbor, the available depth to the wharves being less than 4 feet at mean low water. A 6-foot channel had been dredged at private expense before the United States assumed charge of the improvement, but it had shoaled again to 5 feet.

The existing project, approved August 2, 1882, contemplates dredging an 8-foot channel, 200 feet wide, from Raritan Bay to the steamboat dock at Keyport, at an estimated cost of \$40,475. Report on survey, with estimate, is printed in the Annual Report of the Chief of Engineers for 1873, page 941.

The amount expended to June 30, 1903, was \$50,381.45, of which sum \$30,500 was used in carrying out the project and \$19,881.45 in maintenance.

During the past fiscal year 18,700 cubic yards of material was dredged from the harbor in maintenance.

The maximum draft that could be carried June 30, 1903, to the Keyport wharves was about 8 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this harbor is mainly in farm products, fertilizers, coal, lumber, fish, shellfish, and miscellaneous freight, and amounted to 67,500 tons in 1899, to 45,000 tons in 1901, and to 62,000 tons in 1902.

Further details as to this work are printed in the Annual Report of the Chief of Engineers for 1897, page 1147.

(b) *Matawan Creek*.—This creek is a small tidal stream in the eastern part of New Jersey, which discharges into Raritan Bay at Keyport Harbor. It is navigable up to the bridge of the New York and Long Branch Railroad, about 2 miles above its mouth.

In its natural condition the mouth was obstructed by a mud flat, through which a narrow and crooked 3-foot channel existed. Above this flat there was a 4-foot channel for a mile, and beyond a narrow 3-foot channel extending nearly to the head of navigation, at Matawan.

The existing project for improving this stream, by dredging a 4-foot channel 100 feet wide from the mouth to Winkson Creek, about 1 mile, and thence 75 feet wide to the railroad bridge at Matawan, was approved March 3, 1881. The cost was estimated at \$33,120. Report on survey with estimate is printed in Annual Report of the Chief of Engineers for 1881, page 720.

The amount expended to June 30, 1903, was \$45,120, of which \$21,000 was used in carrying out the project and \$24,120 for maintenance.

During the past fiscal year 11,968 cubic yards of material was dredged from the upper part of the channel for maintenance of same.

The maximum draft that could be carried June 30, 1903, was 4 feet at mean low water. Mean range of tides, 4.9 feet.

The commerce of this creek is in brick, fertilizers, farm produce, and general merchandise, and amounted to 51,000 tons in 1899, to 60,000 tons in 1901, and to 61,500 tons in 1902.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1145.

(c) *Raritan River*.—This river is a moderate-sized stream flowing

through the central part of the State of New Jersey and emptying into Raritan Bay at Perth Amboy. It is navigable to New Brunswick, N. J., a distance of 12 miles, where it is the eastern terminus of the Delaware and Raritan Canal.

In its natural state the channel to New Brunswick was obstructed by several extensive shoals, on which the depth was from $6\frac{1}{2}$ to $8\frac{1}{2}$ feet at mean low water.

The project for improvement, approved June 18, 1878, provided for a channel 200 feet wide and 10 feet deep, from the mouth to the Delaware and Raritan Canal terminus at New Brunswick, to be obtained by dredging, diking, and rock excavation, the cost being estimated at that time at \$2,093,662. Recent and improved methods for doing such work have made it probable that this estimate will not exceed \$1,035,000.

The amount expended up to the close of the fiscal year ending June 30, 1903, was \$669,000.97, of which \$659,192.32 was used in carrying on the work and \$9,808.65 for maintaining that already done.

During the past fiscal year, under appropriation of June 13, 1902, 2,408 cubic yards of material was dredged from the lower part of the river, under a contract for restoration of previously dredged channel.

On June 30, 1903, the maximum draft that could be carried to the head of navigation was 8 feet at mean low water. Mean range of tides: At mouth of river, 5.1 feet; at New Brunswick, 5.56 feet.

The commerce of this river is principally in coal, ores, lumber, building materials, and general merchandise, and amounted in 1899 to 1,523,391 tons, in 1900 to 1,476,645 tons, in 1901 to 1,266,950 tons, and in 1902 to 1,228,791 tons.

Details as to this improvement may be found in the Annual Reports of the Chief of Engineers for 1897, page 1136, and further information is contained in Report for 1900, page 1505.

Map of the river is printed in the Annual Report of the Chief of Engineers for 1885, page 760.

(d) *South River*.—This is a small stream in the central part of New Jersey, which discharges into the Raritan River about 8 miles above its mouth. Before improvement by the United States, a private canal about three-quarters of a mile long had been dredged from near Washington, on the South River, to Sayreville, on the Raritan River, which shortened the sailing course about 2 miles.

The depth in the canal was about 3.5 feet and in the river about 2.5 feet as far as Oldbridge, at the head of navigation, 6.3 miles above the canal.

The first project for this improvement was adopted March 3, 1871, and provided for dredging a channel 6 feet deep at mean low water up to the Washington wharves, at an estimated cost of \$13,653. This was completed in 1874, at a cost of \$20,000.

The present project, approved June 14, 1880, provides for correcting the canal outlet and for obtaining, by dredging and diking, a channel 100 feet wide and 8 feet deep to Washington, 1.5 miles above the mouth; thence 6 feet deep to Bissetts, 3.7 miles above the mouth; thence 4 feet deep to Oldbridge, 6.3 miles above the mouth, at the head of navigation. The cost was estimated at \$194,695, but was reduced in 1892 to \$176,975. Report upon survey, with estimate, for this project is printed in Annual Report of the Chief of Engineers for 1880, page 519.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1903, was \$93,036.95, of which \$78,000 was used for carrying on the work and \$15,036.95 for maintenance.

During the past fiscal year a contract, dated March 24, 1903, for dredging for maintenance, under appropriation of June 13, 1902, has been entered into. Work has not yet commenced.

The maximum draft that could be carried to South River on June 30, 1903, was about 8 feet, and to the railroad bridge above about 5 feet at mean low water. Mean range of tides: At canal, 5.34 feet; at Oldbridge, 4.57 feet.

Large brickyards established along the banks of this river give it a commercial importance out of proportion to its size.

The commerce is principally in brick, clay, coal, and general merchandise, and amounted in 1899 to 343,202 tons, in 1900 to 414,288 tons, in 1901 to 328,186 tons, and in 1902 to 387,246 tons.

Details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1896, pages 784-785.

Sketches of South River are printed in Annual Reports of the Chief of Engineers for 1882, page 678, and for 1885, page 764.

(e) *Elizabeth River*.—This is a small stream in the eastern part of New Jersey, which discharges into the Arthur Kill at Elizabethport. Before improvement by the United States its width varied from 50 to 90 feet, and it had a high-water depth of 4 feet at the head of navigation at Broad street, Elizabeth, about 2½ miles above its mouth.

The existing project, approved March 3, 1879, consists in dredging a channel 60 feet wide and 7 feet deep at mean high water, at an estimated cost, revised in 1881, of \$43,160. Report upon survey with estimate is printed in Annual Report of the Chief of Engineers for 1879, page 481.

The amount expended on this work to June 30, 1903, was \$43,166.50, of which \$27,000 was used for carrying out the project and \$16,166.50 for maintenance.

Under appropriation of June 13, 1902, a contract dated December 16, 1902, has been entered into for maintenance dredging. Work has not been commenced.

The maximum draft that could be carried to Bridge street, Elizabeth, about one-fourth mile from the head of navigation at Broad street, on June 30, 1903, was about 1 foot at mean low water. Mean range of tides: At mouth, 4.7 feet; at Bridge street, Elizabeth, 3.4 feet.

The commerce of this river is in coal, building materials, and miscellaneous freights. It amounted to 21,650 tons in 1895, to 36,066 tons in 1896, to 28,865 tons in 1897, to 29,495 tons in 1901, and to 40,250 tons in 1902.

Details in reference to this improvement may be found in the Annual Reports of the Chief of Engineers for 1896, page 778, and for 1897, pages 1134 and 1185.

(f) *Shoal Harbor and Compton Creek*.—This harbor is on the south shore of Raritan Bay, 5 miles from Sandy Hook. Compton Creek is a narrow stream emptying into it. The natural harbor is inside the mouth of the creek, where the depth is from 3 to 6 feet at mean low tide. The creek is navigable for about 1 mile above its mouth, where it is crossed by a railroad bridge without a draw; one-fourth of a mile above its mouth it is crossed by a highway drawbridge.

The entrance to this harbor was originally obstructed by a broad, flat

shoal, on which there was a depth of less than 1 foot at mean low tide, the distance between the deep water in the creek and the 4-foot depth in the bay being about one-half mile.

The existing project, approved September 19, 1890, proposes a channel 4 feet deep, connecting Compton Creek with Raritan Bay, the width to be 150 feet in the bay and 75 feet in and near the mouth of the creek, the channel through Shoal Harbor to be protected by a dike if necessary. The estimated cost of the work was \$64,130.

The amount expended to June 30, 1903, was \$31,006.86, of which sum \$17,000 was applied to carrying out the project and \$14,006.86 for maintenance.

During the past fiscal year 24,020 cubic yards of material was dredged from this harbor and creek for maintenance of previously dredged channel throughout nearly its entire length.

The maximum draft that could be carried June 30, 1903, in the improved channel through Shoal Harbor and Compton Creek to the drawbridge was 4 feet at mean low water. Mean range of tides, 4.5 feet.

The commerce of this locality in farm and fish products, fertilizers, and general merchandise amounted to 179,500 tons in 1900, to 180,000 tons in 1901, and to 48,790 tons in 1902.

Further details as to this improvement may be found in the Annual Report of the Chief of Engineers for 1897, page 1150.

July 1, 1902, balance unexpended	\$46,355.00
June 30, 1903, amount expended during fiscal year	16,062.73
July 1, 1903, balance unexpended	30,292.27
July 1, 1903, outstanding liabilities	1,232.48
July 1, 1903, balance available	29,059.79
July 1, 1903, amount covered by uncompleted contracts.....	23,698.00
(Amount (estimated) required for completion of existing project	548,110.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	94,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H 5.)

6. *Shrewsbury River, New Jersey.*—This river is a large tidal basin in the eastern part of New Jersey, and consists of two bays, each having an area of about 3 square miles, and known, respectively, as the North Branch, or Navesink River, and the South Branch, and a channel called the main stem, which unites the two branches at their eastern ends and extends northwardly to the outlet at southeast end of Sandy Hook Bay. The river is navigable on the North Branch to Red Bank, 8 miles from the mouth, where it is crossed by three bridges without draws, and on the South Branch to Branchport, 9 miles from the mouth; also to Little Silver, Oceanport, Parkers Creek, North Long Branch, and Monmouth Beach on the several arms of the South Branch.

The part of the river which has been under improvement by the United States consists of the main stem, the North Branch to Oceanic, 5 miles from the mouth, and the South Branch to the vicinity of Sea

bright, about $5\frac{1}{2}$ miles from the mouth. The bays above Oceanic and Seabright had sufficient water to accommodate navigation.

Before any improvement was begun by the United States the available depth to Oceanic, on the North Branch, was $3\frac{1}{2}$ feet and to Seabright on the South Branch it was $2\frac{1}{2}$ feet; the depth in the main stem was 4 feet. For details see Annual Report of the Chief of Engineers for 1886, page 756.

By act of Congress of August 30, 1852, \$1,500 was appropriated for and expended upon a survey to ascertain the extent of a break through the beach between the Shrewsbury River and the ocean, but no work of improvement was begun.

First project: By act of Congress of July 11, 1870, a survey of the river was ordered. The report on this survey, printed in the Annual Report of the Chief of Engineers for 1871, page 702, described a bar across the river nearly opposite the Navesink lights, and four smaller bars above, and recommended deepening them by dredging, at an estimated cost of \$14,000. The work was completed under appropriations amounting to \$19,000, made in 1871 and 1873, and a new shoal near Lower Rocky Point was also dredged. The dredged channels did not long maintain the improved depth (6 feet at low tide).

Existing project, with modifications: The river and harbor act of 1875 provided for a survey of the "North and South branches of the Shrewsbury River, New Jersey." The report on this survey, printed in the Annual Report of the Chief of Engineers for 1876, page 278, proposed dredging at Upper and Lower Rocky Point and a training dike at the entrance to the North Branch, at a total estimated cost of \$18,000. This sum was appropriated by the river and harbor act of 1878, but before beginning the work it was decided to make a new and more detailed survey of the river. This survey was made in 1878, and the report printed in the Annual Report of the Chief of Engineers for 1879, page 405, presented a plan for improving both branches of the river and main stem to obtain a channel of 6 feet depth at mean low water, with a width of 300 feet in the main stem and of 150 feet in each of the branches, by dredging and constructing pile dikes or training walls. At this time the available depth in the main stem was found to be 5.4 feet at mean low water, in the North Branch 3.5 feet, and in the South Branch at the entrance 2.6 feet, practically suspending all navigation in the latter channel. The plan was referred to a Board of Engineers, and with slight modifications was approved by it February 12, 1879. It provided for the construction of seven pile dikes and for dredging at seven different shoal points, at a total estimated cost of \$142,086. This project was adopted March 3, 1879, when an appropriation of \$10,000 was made for beginning work. No essential modification of this project has since been made. Nine dikes have been built, and the shoals have been dredged and redredged frequently in order to maintain the proposed depth of 6 feet. Owing to the change in diking and to the cost of dredging being generally greater than originally estimated, it was found necessary in 1881, 1883, and 1887 to add to the estimate for the completion of the whole work. The existing project for improvement, therefore, is the project of 1879 with the modifications indicated above, and proposes to secure a channel of 6 feet depth at mean low water, with width of 300 feet up to the junction of the North and South branches and with a width of 150 feet in those branches, by means of dredging and diking, at an esti-

mated cost (including appropriation of 1878 applied to this project) of \$231,062.

The sum expended under the existing project at the close of the fiscal year ending June 30, 1903, was \$268,752.35, of which \$168,500 was for carrying out the project and \$100,252.35 for maintenance.

The expenditure during the past fiscal year was for maintenance. Twenty-two thousand five hundred and forty-five cubic yards has been dredged from the main stem, 9,668 yards from the North Branch, and 20,049 yards from the South Branch.

The maximum draft that could be carried June 30, 1903, throughout the limits of the improvement was 6 feet at mean low water in channels not less than 60 feet in width. Mean range of tides: Outer bar, 5 feet; Highland Bridge, 3 feet; Seabright Bridge, 1.3 feet.

The commerce of this river, mainly in coal, farm products, fertilizers, and general merchandise, amounted in 1899 to 906,000 tons, in 1900 to 804,000 tons, in 1901 to 488,000 tons, and in 1902 to 657,000 tons. The passenger traffic is important, the number of people carried by the Patten Line, South Branch, in 1902 being 264,635.

Further details in reference to this work may be found in Annual Reports of the Chief of Engineers for 1896, page 797, and for 1900, page 185.

Sketches of Shrewsbury River are printed in the Annual Reports of the Chief of Engineers for 1879, 1881, 1882, 1887, 1890, 1891, and 1893.

Harbor lines were established in the Shrewsbury River in the vicinity of Seabright by the Secretary of War, February 5, 1894, and at the mouth of the river, along the west shore up to the Highland Bridge, March 9, 1892.

It is expected that report of the survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended.....	\$75,000.00
March, 18, 1903, transferred to Maj. W. L. Marshall	\$5,600.00
June 30, 1903, amount expended during fiscal year.....	14,752.35
	19,752.35
July 1, 1903, balance unexpended.....	55,247.65
July 1, 1903, outstanding liabilities	6,304.90
July 1, 1903, balance available	48,942.75
July 1, 1903, amount covered by uncompleted contracts.....	2,050.56
{ Amount (estimated) required for completion of existing project	20,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix II 6.)

7. *Manasquan River, New Jersey.*—This is a small stream in the eastern part of New Jersey which empties into the Atlantic Ocean about 26 miles south of Sandy Hook. In its natural condition the low-water depth for several miles above the mouth varied from 4 to 6 feet. The outlet, however, was obstructed by a shifting sand bar on which the depth did not exceed 1½ feet. After severe storms this outlet was sometimes entirely closed, remaining so until sufficient fresh

water had accumulated in the river above to force an outlet into the ocean.

A project for its improvement, adopted by the river and harbor act of March 3, 1879, contemplated obtaining a permanent outlet for the river nearly at right angles to the shore, with a depth of 6 feet at mean low water; also dredging a channel in the lower river to the same depth. The estimated cost was \$52,120. Work was suspended in 1883, after three appropriations, amounting to \$39,000, had been expended on the improvement.

The existing project, approved March 3, 1899, which is a modification of the original project, contemplates obtaining an outlet 6 feet deep for the river, and also in deepening the channel just above the mouth to the same depth, at an additional cost of \$18,300 over the amount expended and on hand, making the total estimated cost of the improvement \$59,300, to which should be added \$1,075 expended for maintenance.

The amount expended to June 30, 1903, was \$40,075, of which \$39,000 was used for carrying out the project and \$1,075 for maintenance.

No work was done during the past year.

The available balance will be held until another appropriation shall have been made, with the expectation that better prices will be obtained for a greater amount of work.

The maximum draft that could be carried June 30, 1903, was about 2 feet at mean low water. Mean range of tides, 2.4 feet.

The commerce amounts practically to nothing. The river is used principally by pleasure craft during the summer season.

Detailed description of this improvement with map is printed in the Annual Report of the Chief of Engineers for 1898, page 1070.

Full history of the work and map are printed in the Annual Reports of the Chief of Engineers for 1880, Part I, pages 547 to 556, and for 1882, Part I, page 701.

July 1, 1902, balance unexpended	\$5, 925. 00
July 1, 1903, balance unexpended	5, 925. 00

{ Amount (estimated) required for completion of existing project	14, 375. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	7, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix H 7.)

8. *Removing sunken vessels or craft obstructing or endangering navigation.*—(a) *Wreck of barge Eldorado in Passaic River, New Jersey.*—The *Eldorado*, loaded with lumber, sunk in the Passaic River below the Erie Railroad bridge. The sum of \$15 was allotted June 27, 1902, for an examination of the wreck. It was removed by the owner on July 5, 1903.

(b) *Wrecks of two unknown canal boats, and wreck of canal boat F. D. Towner in Newark Bay, New Jersey.*—These wrecks were reported floating around Newark Bay and were dangerous obstructions to navigation. The wrecks finally grounded near the shore. An allotment of \$1,200 for the removal of the wrecks was made on July 31, 1902, and the work of removal was accomplished on August 27, 1902.

(c) *Wreck of barge Will Sherman in Arthur Kill, New York and*

New Jersey.—This wreck was sunk and abandoned in the Arthur Kill, at the mouth of Morses Creek, near Elizabethport, N. J., and was considered a menace to navigation. An allotment of \$528 was made for its removal on November 18, 1902, and the wreck was entirely removed and disposed of on November 27, 1902.

(d) *Wreck of barge Antoinette Fisher in Elizabeth River, New Jersey.*—This wreck sunk in the Elizabeth River, near the mouth of the stream. The removal of the wreck and cargo was completed by the owners on December 29, 1902.

(e) *Wreck of barge Leon Fisher in Passaic River, New Jersey.*—The *Leon Fisher*, loaded with brick, sunk in the Passaic River at the foot of Commercial street, Newark. The removal of the wreck was completed by the owners January 19, 1903.

(f) *Wrecks of two unknown canal boats in Newark Bay, New Jersey.*—These wrecks were located in Newark Bay, one east of the Passaic light-house and one opposite Twenty-first street, Bayonne, N. J., and were obstructions to navigation. The sum of \$600 was allotted March 2, 1903, to remove the wrecks, which work was accomplished on April 10, 1903.

(g) *Wreck of canal boat Laura E. Plantz in Raritan River, New Jersey.*—This wreck loaded with clay was sunk near the wharf of the Bloomfield Clay Company in such a manner as to obstruct navigation. An allotment of \$600 was made on March 2, 1903, for its removal. The work of removal was commenced on March 18, 1903, and completed on April 6, 1903.

(h) *Wreck of unknown canal boat in Arthur Kill, New Jersey.*—This wreck was reported on March 18, 1903, and an examination made revealed the wreck in the channel of the Arthur Kill, off the Port Reading coal docks, and it was an obstruction to navigation. The sum of \$350 for its removal was allotted on March 24, 1903, and the work completed on March 30, 1903.

The total cost of removing these wrecks was \$2,487.09.

(See Appendix H 8.)

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA, AND OF CERTAIN WORKS IN DELAWARE BAY, DELAWARE.

The works in this district were in the temporary charge of Capt. Spencer Cosby, Corps of Engineers, to August 20, 1902; in the charge of Lieut. Col. C. W. Raymond, Corps of Engineers, from August 20, 1902, to May 11, 1903, and of Capt. J. C. Sanford, Corps of Engineers, since May 11, 1903. Division Engineer, Col. Amos Stickney, Corps of Engineers, since May 11, 1903.

1. *Delaware River, New Jersey and Pennsylvania.*—Trenton, the head of natural and actual navigation on the Delaware River, is about 30 miles above the upper end of the port of Philadelphia. In its original condition this stretch of river was obstructed by several shoals. Between Bordentown and Trenton, a distance of about 5 miles, a narrow and circuitous channel existed, which carried only from 3 to 6 feet at mean low water. At Kinkora bar, about 9 miles below Trenton, there was a shoal carrying 7½ feet, and at Five-mile bar, opposite the upper part of Philadelphia, a shoal crossed the Pennsylvania channel carrying only 3 to 4 feet at mean low water; there was, however, a depth of 13 feet past Five-mile bar in the New Jersey channel south of Petty Island.

Below Philadelphia the river in its original condition presented obstructions at Mifflin bar which reduced the depth at mean low water to 17 feet, at Schooner ledge and Cherry Island flats to 18 feet, at Bulkhead shoal and Baker shoal to about 20 feet, and at Duck Creek flats to about 20 feet.

In that part of the Delaware River between Trenton, N. J., and Bridesburg, Pa., efforts in the past have been directed toward relieving commerce from the obstructions which exist in the upper 9 miles of the river and toward deepening the channel across Kinkora bar.

Previous to 1885 the efforts to improve the river between Philadelphia and the bay were confined to dredging, except at Schooner ledge, where solid rock was removed. The work was done under appropriations for special localities, and also under general appropriations for the Delaware River below Bridesburg.

A Board of Engineers convened by direction of the Secretary of War for the purpose of considering the subject of the permanent improvement of Delaware River and Bay recommended, under date of January 23, 1885, the formation of a ship channel from a point opposite Philadelphia and about midway between the American Shipbuilding Company's yard and the Gas Trust wharf to deep water in Delaware Bay, having a least width of 600 feet and a depth of 26 feet at mean low water. The formation of such a channel was to be obtained, except at Schooner ledge, where rock would have to be removed, by regulating the tidal flow by means of dikes, with recourse to dredging where necessary as an aid to such contracting and regulating works.

The estimated cost of obtaining a channel of the above dimensions was about \$2,425,000, which covered the estimated cost of the permanent improvement of the Delaware River between the upper part of Philadelphia and deep water in the bay. The annual cost of maintenance was estimated at 10 per cent of the original cost for dredging and 1 per cent of the original cost for dikes. This estimate of cost did not include the improvement of Philadelphia Harbor, which was a separate project.

In the river and harbor act approved March 3, 1899, Congress adopted a new project for the improvement of the river, providing for the formation of a channel 600 feet wide and 30 feet deep from Christian street, Philadelphia, to deep water in Delaware Bay, at an estimated cost of \$5,810,000. This project superseded the project of 1885, which provided for a depth of 26 feet at mean low water. At the time of adoption of the new project the 26-foot channel, with widths varying from 200 to 600 feet, had been formed from the upper part of Philadelphia Harbor to the bay, except at the following-named localities: Tinicum Island shoal, depth from 23.6 feet to 26 feet over a distance of about 4,200 feet; above Schooner ledge, depth from 24 feet to 26 feet over a distance of about 4,800 feet; from below Marcus Hook to Bellevue, depth from 23 to 26 feet over a distance of about 13,500 feet. These distances are measured on the range lines. The distances measured between the 26-foot curves on the lines of deepest water were much shorter.

At the same time there was between Trenton and Philadelphia a channel 6 feet deep at mean low water through Perriwig bar, a depth of 7 feet in the eastern channel at Bordentown, a channel 8½ feet deep through Kinkora bar, and a channel 26 feet deep over the whole width through Five-mile bar.

The entire amount expended on the improvement of the Delaware River from 1836 to June 30, 1903, under appropriations for special localities and the general river, was \$4,055,491.57, of which \$124,500 was expended on the part of the river between Trenton and Philadelphia.

The total amount expended on the 26-foot project since its adoption in 1885 was \$1,532,687.46, of which about \$200,000 is estimated to have been applied to maintenance. In addition to this expenditure the following sums were expended since the adoption of the 26-foot channel in 1885 on special localities on the river under appropriations made for the purpose:

Channel across Smiths Island bar, between Philadelphia, Pa., and Camden, N. J.....	\$30,000.00
Between the upper part of Philadelphia, Pa., and Trenton, N. J.....	37,500.00
Rebuilding and enlarging dike at junction of Schuylkill and Delaware rivers	3,000.00
Removing rock ledge opposite Petty Island	69,463.26
Expenses of Board of Engineer officers on project for channel 30 feet deep and 600 feet wide.....	7,000.00

146,963.26

Up to the close of the fiscal year ending June 30, 1903, the sum of \$1,023,840.85 was expended on the work of the existing project in surveys, in operations at Baker and Duck Creek flats shoals, and in the construction of bulkheads for the reception of dredged material. None of this amount was applied to maintenance of improvement.

The changes during the past fiscal year are summarized as follows:

At Baker shoal the work of bulkhead construction has resulted in the completion of about 2,500 additional linear feet of the structure, the total length constructed to date being 14,197 linear feet. The work of dredging under the 30-foot project has resulted in the formation of a channel 30 feet deep at mean low water about 20,500 feet long and with an average width of 590 feet through the upper part of Baker shoal, and of a channel of the same depth with length of 27,700 feet and an average width of 350 feet through a part of Duck Creek flats shoal.

The greatest draft of water that could be carried at mean low water on June 30, 1903, over the shoalest part of the river below Philadelphia was about 20.6 feet at Cherry Island flats. The nature of the bottom is such, however, that vessels drawing somewhat more than the available depth pass over it without difficulty. The mean range of tide is 5.35 feet.

For 1890 the total foreign freight movement of the Delaware River was estimated at 2,923,994 tons and the total domestic freight movement at 8,433,276 tons; total, 11,356,270 tons. For 1902 the total foreign freight movement was estimated at 4,428,242 tons, and the total domestic freight movement at 17,414,967 tons; total, 21,843,209 tons.

The additional work proposed in the approved project, and for a part of which funds were provided by the river and harbor act of June 13, 1902, and sundry civil act of March 3, 1903, is necessary to make the improvement available and will largely benefit commerce.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1901 and 1902, is compiled from the reports of

the Board of Trade, the Commercial Exchange, and the Maritime Exchange of the city of Philadelphia:

Articles.	1901.	1902.
IMPORTS.		
	<i>Tons.</i>	<i>Tons.</i>
Chalk	44, 213	41, 121
Drugs and chemicals	89, 673	154, 922
Hemp, jute, flax, and their fabrics	31, 151	33, 112
Iron, ore	332, 651	339, 880
Sugar	963, 052	289, 603
Miscellaneous	418, 304	820, 765
Total	1, 279, 044	1, 679, 408
EXPORTS.		
Coal	687, 274	566, 263
Grain and flour	1, 076, 777	638, 423
Petroleum and products	1, 041, 856	1, 164, 188
Miscellaneous	377, 677	379, 965
Total	3, 183, 584	2, 748, 839

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1901 and 1902, has been compiled from returns made by shippers, consignees, and carriers:

Articles.	1901.		1902.	
	Tons.	Value.	Tons.	Value.
ARRIVALS.				
Chemicals	82, 563	\$2, 363, 603	101, 290	\$4, 354, 684
Coal	493, 761	1, 558, 889	330, 327	1, 222, 067
Lumber	961, 743	12, 661, 662	845, 520	26, 154, 190
Sand	1, 100, 601	743, 577	1, 388, 706	685, 247
Miscellaneous	3, 921, 129	561, 453, 804	4, 150, 973	752, 589, 559
Total	6, 559, 797	578, 792, 535	6, 816, 816	785, 005, 737
DEPARTURES.				
Chemicals	84, 334	1, 952, 160	52, 220	2, 000, 556
Coal	8, 085, 691	36, 988, 151	6, 117, 246	24, 066, 876
Fertilizers	101, 723	1, 554, 188	86, 571	1, 515, 955
Iron, manufactured	123, 511	4, 896, 443	89, 375	4, 215, 700
Miscellaneous	4, 662, 940	451, 954, 346	4, 252, 739	673, 346, 954
Total	13, 068, 099	497, 345, 288	10, 598, 151	705, 146, 041

July 1, 1902, balance unexpended \$907, 465. 95
Amount appropriated by sundry civil act approved March 3, 1903..... 1, 400, 000. 00

June 30, 1903, amount expended during fiscal year 2, 307, 465. 95
758, 957. 52

July 1, 1903, balance unexpended 1, 548, 508. 43
July 1, 1903, outstanding liabilities 165, 729. 84

July 1, 1903, balance available 1, 382, 778. 59

July 1, 1903, amount covered by uncompleted contracts 1, 622, 521. 54

{ Amount (estimated) required for completion of existing project 3, 254, 463. 26
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903..... \$2, 000, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix I 1.)

*Of this amount \$1,000,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

2. *Iron pier in Delaware Bay, near Lewes, Del.*—The original project for this work proposed the construction of a landing pier about 1,700 feet in length, extending from the shore south of the breakwater into Delaware Bay to a depth of 22 feet at mean low water, the pier to consist of a substructure of wrought-iron screw piles, surmounted by a timber superstructure. The work was commenced in 1871 and completed, except as to superstructure, in 1880.

The work done to June 30, 1890, resulted in the construction of 1,155 linear feet of pier 21 feet in width and 546 linear feet 42 feet in width, or a total length of 1,701 feet. The depth of water at the outer end of the pierhead was about 21 feet at mean low water. Since construction the pier has been repaired and cared for by the United States.

The total expenditure to June 30, 1903, was \$385,339.40. Of this amount, \$27,000 was applied to the maintenance of the improvement.

The right to use the pier for railway purposes, granted in the act of July 15, 1870, has never been exercised and doubtless never will be, as the pier has not sufficient strength to support the weight of modern freight engines. It is therefore impossible to obtain any assistance from the railroad company in maintaining and repairing the structure.

During the past fiscal year no work has been in progress.

The pier is of great use for the purposes of the Government engineer, light-house, and quarantine services. It is of very great value to vessels frequenting the breakwater harbor in winter, when the harbor is packed with floating ice, rendering the anchorage dangerous. At such times vessels eagerly seek its shelter and protection.

It is proposed to hold the available balance of \$820.60 for maintenance and repairs as needed.

The mean range of tide at the pier is 4.5 feet.

July 1, 1902, balance unexpended	\$820.60
July 1, 1903, balance unexpended	820.60

(See Appendix I 2.)

3. *Delaware Breakwater, Delaware.*—The final report of the local officer upon this work was submitted June 19, 1899, and is printed in the Annual Report of the Chief of Engineers for 1899, page 1346.

The depths in the protected anchorage vary from 11½ to 18 feet at mean low water, and the harbor is available for vessels drawing up to about 16 feet.

The amount expended on this work up to June 30, 1903, was \$2,807,479.06. No portion of this amount has been applied to maintenance.

During the past fiscal year a survey of the breakwater harbor was completed as a part of a survey of the national harbor of refuge.

The mean range of tide is 4.5 feet.

The Maritime Exchange of Philadelphia maintains a station on the breakwater, and through cables between the mainland and its station is in communication with the shipping of the harbor. Its reports state that during the year 1902 1,085 vessels, exclusive of tugs and fishing and small coasting craft, anchored under the protection of the breakwater.

It is proposed to reserve the available balance of \$874.38 for repairs to the breakwater and for surveys and examinations of the work.

July 1, 1902, balance unexpended	\$874.64
July 1, 1903, balance unexpended	874.64
July 1, 1903, outstanding liabilities	.26
July 1, 1903, balance available.....	874.38

(See Appendix I 3.)

4. *Harbor of refuge, Delaware Bay, Delaware.*—The project for the construction of this harbor, which was adopted and provided for on the continuous-contract system in the river and harbor act of June 3, 1896, includes the construction of a breakwater on the line of least depth along the eastern branch of the shoal known as the "Shears," and the construction of a row of ice piers across the upper end of the harbor to protect it from ice descending the bay, at a total cost not to exceed \$4,665,000.

No expenditures were made on this improvement previous to June 30, 1896.

Up to the close of the fiscal year ending June 30, 1903, \$2,237,862.66 had been expended in the construction of the breakwater and ice piers. No part of this amount was applied to the maintenance of the work.

The breakwater was completed on December 11, 1901. The superstructure of the breakwater has a length of 7,950 feet and the substructure a length of 8,040 feet measured on the low-water line.

A project for the construction of 10 ice piers was submitted on April 5 and approved April 23, 1900. This work was commenced during the fiscal year ending June 30, 1901, and completed November 22, 1902. Seventy-one thousand three hundred tons of stone was deposited in the work.

A project for the construction of additional ice piers was submitted under date of June 7 and approved June 30, 1902. Work under this project was begun August 4, 1902, and completed June 19, 1903. Thirty-seven thousand six hundred and seventy-three tons of stone was deposited, completing 5 ice piers.

It is expected that report will be submitted to Congress in December, 1903, upon a preliminary examination made of Delaware Bay harbor of refuge, with a view to ascertaining what further protection is necessary, if any, in accordance with a provision of the river and harbor act of June 13, 1902.

It is proposed to reserve the available balance of \$1,470.88 for repairs and surveys and examinations of the work.

The great value of this harbor to commerce is due to its location. It is about equidistant from New York, Philadelphia, and the capes of Chesapeake Bay (the ocean entrances to the ports of Baltimore, Norfolk, and Newport News), and is therefore an especially convenient point of call for the entire commerce of the North Atlantic coast. It is now largely used by vessels awaiting orders to ports for discharge or loading. During the year ending December 31, 1902, 1,085 vessels (not including small craft) called at this harbor.

By the construction of the breakwater the usefulness of this anchorage has been greatly increased, not only as a port of call, but also as a harbor of refuge. Vessels bound from northern to southern or from southern to northern ports are able to go to sea in doubtful weather with the assurance of finding ample protection at the Delaware capes if overtaken by storm.

Details as to this improvement may be found in Annual Report of the Chief of Engineers for 1897, page 1216. A map is printed in House Executive Document No. 112, Fifty-second Congress, first session.

The mean range of tide is 4.5 feet.

July 1, 1902, balance unexpended	\$148,568.18
June 30, 1903, amount expended during fiscal year	147,096.84
July 1, 1903, balance unexpended	1,471.34
July 1, 1903, outstanding liabilities	.46
July 1, 1903, balance available	1,470.88

(See Appendix I 4.)

5. *Removing sunken vessels or craft obstructing or endangering navigation.*—(a) *Wreck of schooner Mary E. Insley in Delaware Bay.*—This vessel sunk July 3, 1902, near Cross ledge light-house, interfered with navigation, and its removal was authorized on July 25, 1902. The work of removal was completed September 27, 1902. The total cost was \$392.38.

(b) *Wreck of schooner Milton R. Studhams and sloop Mary W. Meerwald.*—These vessels were sunk in March, 1902, the former about 5½ miles above Ship John light-house, and the latter near False Egg Island Point in Delaware Bay. They were dangerous obstructions to navigation to small vessels and oyster boats frequenting the locality, and their removal was authorized on October 13, 1902. The removal of the *Milton R. Studhams* was completed December 19, 1902, and the *Mary W. Meerwald* January 23, 1903. The total cost of removing these wrecks was \$625.01.

(c) *Wreck of forward section of barge Harry E. Bird in Delaware River near Broad street.*—This wreck, lying about 900 feet above Broad street wharf in the Delaware River, was considered an especially dangerous obstruction to navigation; its removal was authorized on March 4, 1903. The work of removal was completed May 19, 1903. The total cost was \$335.95.

(d) The removal of the wreck of the schooner *Lottie K. Friend* from Delaware Bay, under a contract dated February 18, 1897, with Thomas Poynter and Elijah D. Register, of Lewes, Del., in progress during the fiscal year ending June 30, 1897, was not completed, and the annulment of the contract was recommended June 16, 1898, and approved June 18, 1898. This wreck has not yet been removed.

The amount expended during the past fiscal year upon removal of wrecks is \$1,353.34.

(See Appendix I 5.)

IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PA., OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY, IN DELAWARE, AND IN MARYLAND ON THE EASTERN SHORE OF CHESAPEAKE BAY; INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

This district was in the charge of Col. Jared A. Smith, Corps of Engineers (now brigadier-general United States Army, retired), to April 11, 1903, and of Capt. J. C. Sanford, Corps of Engineers, since that date. Division Engineer, Col. Amos Stickney, Corps of Engineers, since April 11, 1903.

1. *Ice Harbor at Marcushook, Pa.*—In 1785 the Commonwealth of Pennsylvania built two wharves upon crib piers at Marcushook for the convenience of commerce. In 1829 an appropriation was made by Congress for repairing the piers and improving the harbor.

In 1866 a project was adopted for a harbor in the Delaware River to protect vessels against moving ice. The old work at Marcushook was utilized as far as possible. The amount expended from 1866 to June 30, 1903, was \$212,300.99. Since 1889 all expenditures have been for repairs and maintenance. The last amount appropriated for the work was \$5,000, by act of September 19, 1890.

The harbor covers an area of 12 acres, of which about one-half has a depth of 12 to 18 feet and the other half 18 to 25 feet at mean low water. The protection consists of the old landing piers and seven detached piers having superstructures of wooden cribs filled with stone, and superstructures faced with cut stone. The detached piers appear to be in good condition. The landing piers are in bad condition, owing to decay and loss of material. It is now proposed to repair these piers at an estimated cost of \$1,500.

No work was done during the year. The expenditure was for contingent expenses.

July 1, 1902, balance unexpended	\$1, 715. 72
June 30, 1903, amount expended during fiscal year	16. 71

July 1, 1903, balance unexpended	1, 699. 01
--	------------

(See Appendix J 1.)

2. *Rancocas River, New Jersey.*—The Rancocas River is a tributary of the Delaware River, its mouth being about 11 miles above the Pennsylvania Railroad terminal and ferry at Camden, N. J.

In its original condition the minimum depth was $4\frac{1}{2}$ feet at mean low water from the junction of the forks near Centerton to its mouth, a distance of $7\frac{1}{2}$ miles. Above Centerton the depth on the Mount Holly Branch, a distance of $5\frac{1}{2}$ miles, was generally about $2\frac{1}{2}$ feet. From the forks to Moores Landing on the Lumberton Branch, a distance of 3.6 miles, the low-water depth over shoal places was 3 feet. The mean range of tides at Centerton is about 5 feet.

The original project of 1881 proposed the formation, by a dike at Coates bar and dredging elsewhere, of a channel from 150 to 200 feet wide and 6 feet deep at mean low water from the mouth to Centerton, and thence to Mount Holly a channel 5 feet deep. Operations under this project were carried on from 1881 to 1885, and to the close of the fiscal year ending June 30, 1895, had been directed to the formation of a low-water channel 100 feet wide and 6 feet deep from the mouth to Centerton, and 50 feet wide and 5 feet deep for a distance of about $1\frac{1}{2}$ miles above Centerton.

An appropriation of \$2,000 for this river, made in the act of June 3, 1896, was required by the act to be expended in the improvement of the Lumberton Branch, and was applied in the fiscal year 1898 to dredging through the shoals at Pattersons Landing, below Paxsons Landing, and partly through the shoal above Paxsons Landing, the channel having a width of 30 feet and a mean low-water depth of 6 feet; and an appropriation of \$2,000 made in the river and harbor act of March 3, 1899, was likewise required to be expended in the Lumberton Branch, and was applied to dredging a channel with a depth of from 6 to 7 feet at mean low water and a width of 30 feet through the shoal below Moores Landing.

By the river and harbor act of June 13, 1902, an appropriation of \$3,000 was made for continuing the improvement of the Lumberton Branch, and for its expenditure a contract has been made for the construction of contraction works, or wing dams, to be placed on the Lumberton Branch of the river, the work to be completed by August 29, 1903. Under this contract work was begun on May 11, 1903, and by the close of the fiscal year 5 wing dams of the 18 to be built had been completed, and others were more or less advanced in construction, about 60 per cent of the entire work being completed.

The amount expended on this improvement to June 30, 1903, was \$41,853.03, of which \$4,352.82 was on the Lumberton Branch.

The maximum draft that could be carried on June 30, 1903, at mean low water over the shoalest part of the channel between "The Forks" and Moores Landing is $3\frac{1}{2}$ feet.

The commerce reported for the past calendar year is 432,418 tons, valued at \$9,091,757. In 1891 the receipts and shipments were reported to be 171,300 tons.

July 1, 1902, balance unexpended	\$3,399.70
June 30, 1903, amount expended during fiscal year	352.82

July 1, 1903, balance unexpended	\$3,046.88
--	------------

July 1, 1903, amount covered by uncompleted contracts	2,400.00
---	----------

(See Appendix J 2.)

3. *Cooper Creek, New Jersey.*—This creek enters the Delaware River in the city of Camden, just above Cooper Point. It is navigable at mean high water for a distance of 9 miles from its mouth for vessels drawing 5 feet, and for the first 5 miles for vessels of $11\frac{1}{2}$ feet draft. The mean range of the tide at the mouth is about 6 feet. For a distance of $1\frac{1}{2}$ miles from the mouth the width of the stream averages about 80 feet at low water and about 120 feet between the banks, and the channel in its original condition had a depth at mean high water of from 12 to 15 feet, except at one place, where the depth was $9\frac{1}{2}$ feet.

The project for this improvement was adopted in the river and harbor act of June 3, 1896, and is printed in the Annual Report of the Chief of Engineers for 1895, page 1102. It provides for the formation by dredging of a channel 70 feet wide at bottom and 18 feet deep at mean high water from the mouth of the creek to Browning's Chemical Works, and a channel of the same dimensions through the bar just outside the mouth, in all a distance of about 9,000 feet. The estimated cost, including contingencies, is \$35,000.

The river and harbor act of June 3, 1896, appropriated \$37,000 for completing this improvement, of which \$2,500, or as much thereof as might be necessary, was to be expended in rebuilding the dike on the Government reservation in the Delaware River at Woodbury Creek.

During the fiscal year ending June 30, 1897, the sum of \$2,500 was expended in rebuilding the dike on the Government reservation at Woodbury Creek.

The dredging resulted in the formation of a channel extending from the mouth to the Camden Iron Works, 7,500 feet long, 50 to 70 feet wide, except at the bridges, where the widths are 30 feet, and 18 feet deep at mean high water, except on the water pipe belonging to the city of Camden, where the high-water depths are 14 to 15 feet.

^a\$399.70 pertains to Mount Holly Branch.

The work done during the past fiscal year was the removal of a large tree which had fallen across the stream, blocking navigation, and the repair of the damage done to the river bank thereby.

The amount expended on the improvement to June 30, 1903, is \$25,859.72, exclusive of the \$2,500 expended in rebuilding the dike on the Government reservation at Woodbury Creek. Of this amount \$183.62 was for maintenance.

It is proposed to complete the improvement with funds now available as soon as the city of Camden removes or lowers the water pipe at State Street Bridge. The maximum draft of water that could be carried at mean low water on June 30, 1903, over the shoalest part of the locality under improvement was about 8 to 9 feet, which is the low-water depth on the pipe above mentioned.

No complete commercial statistics have been attainable for the past year, but the commerce is reported to have been about the same as in 1902. That showed a tonnage of 726,883, valued at \$3,707,048.

July 1, 1902, balance unexpended	\$8, 823. 90
June 30, 1903, amount expended during fiscal year	183. 62

July 1, 1903, balance unexpended	8, 640. 28
--	------------

(See Appendix J 3.)

4. *Mantua Creek, New Jersey.*—Mantua Creek is a stream flowing into the Delaware River at a point about 10 miles below the terminal and ferry of the Pennsylvania Railroad at Camden, N. J.

In its original condition it was navigable at high water for a distance of one-half mile above its mouth to the phosphate works of the I. P. Thomas & Sons Company for vessels of 13 feet draft; thence $3\frac{1}{4}$ miles farther to Paulsboro for vessels drawing 9 feet; thence $3\frac{1}{4}$ miles to Parkers Landing for tugs and barges drawing 6 feet, this being the head of steam navigation; thence 4.1 miles to Mantua, $11\frac{1}{4}$ miles above the mouth, small boats and barges of 3 to 4 feet draft passed up on the tide. The navigable portion is generally bordered by low ground protected from overflow by earthen banks. The general course of the stream is tortuous and its navigation is much obstructed by bars, sharp bends, and the upper portion by stumps and overhanging trees. The stream, on account of its flat watershed, is subject to only moderate freshets, which seldom exceed 2 to 3 feet above tide water. The range of tide is 6 feet at the mouth, 4.5 feet at Paulsboro, 3.4 feet at Berkley, and 2 feet at Mantua, which is the head of navigation. The low-water width near the mouth averages 160 feet, decreasing to about 100 feet at Paulsboro. Above Paulsboro the width decreases to 88 feet at Parkers Landing and near Mantua to 50 feet.

The approved project for the improvement, which was adopted by Congress in river and harbor act of March 3, 1899, contemplates the dredging of a channel 100 feet wide on the bottom and 12 feet deep from the 12-foot contour in the Delaware River through the marsh to the phosphate works, a distance of 2,200 feet; thence 80 feet wide on the bottom and 8 feet deep to Paulsboro, 6,300 feet, making a channel nearly direct by cutting off three bends; thence to Parkers Landing near Berkley, 3 miles, with one cut-off 60 feet wide and 7 feet deep; and the dredging of a cut-off 350 feet long, 50 feet wide, and 3 feet deep 9,000 feet above Berkley; also the removal of overhanging trees above Berkley and the construction of jetties on both sides at the mouth of the creek. The estimated cost of this improvement was

\$145,030. Such land and rights as were considered necessary for the cut-offs were purchased in September, 1900, at a cost of \$8,000, and during the fiscal year ending June 30, 1901, the channel between the phosphate works and Paulsboro was dredged to the project dimensions and the three cut-offs made as planned.

The river and harbor act of June 13, 1902, appropriated \$35,000 for continuing this improvement, and contract has been made to apply so much of this as may be required in dredging the channel from the Delaware River to the phosphate works to a depth of 12 feet at mean low water and a width of 100 feet at bottom, the work to be completed by October 31, 1903. The amount of the appropriation which remains unexpended upon the completion of the dredging will be applied to the construction of jetties, should they be found necessary for the permanent maintenance of the channel across the bar.

No work has been done during the past fiscal year. The expenditure was for examination and contingent expenses.

The maximum draft that could be carried at mean low water on June 30, 1903, over the shoalest part of the channel to the phosphate works is 8 feet; to Paulsboro 5.5 feet, and to Parkers Landing 2.6 feet.

The amount expended on this improvement to June 30, 1903, is \$28,008.33, of which \$25,008.33 was on the present project.

No reliable detailed commercial statistics have been obtained, but the tonnage is probably about 200,000, valued at about \$3,000,000 per annum.

July 1, 1902, balance unexpended	\$35, 127. 66
June 30, 1903, amount expended during fiscal year	135. 99
July 1, 1903, balance unexpended	34, 991. 67
July 1, 1903, amount covered by uncompleted contracts	17, 500. 00
{ Amount (estimated) required for completion of existing project	85, 030. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 4.)

5. *Alloway Creek, New Jersey.*—This is a tidal tributary of the Delaware River, flowing westerly in the southwestern part of New Jersey, its mouth being about 50 miles below Camden, N. J. In its original condition the creek was obstructed between its mouth and Quinton, a distance of about 10 miles, by shoal areas in the upper half of the stream, which reduced the low-water depths to from 1.3 to 4 feet. The mean range of tide is 6 feet at the mouth and 4 feet at Quinton.

The original project of 1889 proposed the formation by dredging of a channel 6 feet deep at mean low water and 60 feet wide from Quinton to a point about 1,000 feet above upper Hancock Bridge; thence a channel of the same depth and 75 feet wide to a locality known as the "Square," where the work is to be supplemented by a dike. At a locality known as the "Canal," in addition to a channel of the last-named dimensions, the width of the stream was to be increased to about 150 feet between its low-water lines. The project was modified on December 10, 1896, so as to provide for a dike formed by a single row of piles above upper Hancock Bridge. This modification does

not increase the original estimated cost of the work, which is \$25,000.

At the close of the fiscal year ending June 30, 1900, \$18,000 had been expended in dredging below the "Square," at the "Square," at "Smith Reeves," at and near the "Canal," just below upper Hancock Bridge, from upper Hancock Bridge to a point about 1,400 feet above it, above and below Robinsons Landing, upper and lower Fowers, upper and lower Lamberts, and Quinton, and in dike construction at the "Square" and above upper Hancock Bridge. Channels from 40 to 75 feet wide and 6 feet deep at mean low water had been dredged at the above-mentioned localities, and dikes 300 and 404 feet in length, respectively, had been constructed at the "Square" and above upper Hancock Bridge. Of this amount about \$1,200 had been expended for the maintenance of dredged channels.

The river and harbor act of June 13, 1902, appropriated \$3,000 for continuing the improvement, and with this appropriation the channel was dredged during the months of April, May, and June, 1903, at various points between the upper end of a shoal just above Hancock Bridge and a point about 3 miles below, forming a continuous channel 6 feet deep at mean low water and 60 feet wide between the points named.

The amount expended on this improvement to June 30, 1903, was \$20,689.02, of which about \$4,200 was for maintenance.

The maximum draft that could be carried on June 30, 1903, at mean low water over the shoalest part of the locality under improvement was 5 feet.

The commerce of this creek consists of miscellaneous articles, such as coal, sand, lumber, agricultural products, etc., the tonnage being 54,081, and valuation \$1,153,875 for the year.

July 1, 1902, balance unexpended	\$3, 000. 00
June 30, 1903, amount expended during fiscal year	2, 689. 02
July 1, 1903, balance unexpended	310. 98
July 1, 1903, amount covered by uncompleted contracts	234. 25
{ Amount (estimated) required for completion of existing project	8, 200. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 5.)

6. *Goshen Creek, New Jersey.*—In its original condition, Goshen Creek carried a low-water depth of from 2 to 4 feet, with a least low-water width of 20 feet and a high-water width of 36 feet from Goshen to a point about 4,000 feet below; and thence to the mouth, a distance of about 2,500 feet, a low-water depth of from 3 to 5 feet, with a least width of 30 feet.

The project for its improvement, adopted in 1891, proposed the deepening and widening by dredging of the 4,000 feet of the creek below Goshen Landing to a low-water depth of 3 feet and a width of 30 feet; the formation of a dredged channel 3 feet deep and about 50 feet wide through the bar at the mouth to the limit of the sand beyond the low-water line, and the protection of the channel by a sheet-pile jetty.

The improvement was commenced during the fiscal year ending

June 30, 1893, and to the close of the year the sum of \$2,770.16 had been expended in widening and deepening the channel to the proposed dimensions over a distance of about 3,975 feet below Goshen Landing. By this work about one-fourth of the projected improvement had been completed and the navigable conditions had been proportionately improved.

During the fiscal year ending June 30, 1897, the pile dike was constructed to its projected length of 600 feet, and 8,002 cubic yards of material was removed from the channel in the vicinity of the dike.

The original cost of the project made in 1891 was estimated at \$12,000, this estimate being based on a single appropriation of that amount by which the improvement could be made in a single season. On account of the small appropriations the execution of the work was carried through an interval of several years, and it was not executed with sufficient rapidity to prevent injurious changes, which considerably increased the cost of the improvement.

During the fiscal year ending June 30, 1898, an estimate for the completion of the project, based on a careful survey of existing conditions, was made. In order to maintain the dredged channel it was found necessary to extend the dike somewhat farther inshore and dredge through the bar at the mouth of the creek, which increased the cost of the project from \$12,000, as originally estimated, to \$17,000.

The river and harbor act of March 3, 1899, appropriated \$8,000 for the completion of this improvement. During the fiscal year ending June 30, 1899, a project for the expenditure of this sum and of a balance remaining from a previous appropriation was submitted and approved. The project provides for dredging a channel with a low-water depth of 3 feet entirely through the mouth of the creek and for repairing and extending the existing dike and constructing a short dike on the upper side of the mouth of the creek. Work under this project was commenced during the fiscal year ending June 30, 1899.

During the fiscal year ending June 30, 1900, under this project the existing dike was repaired and strengthened with brush and stone; two parallel brush and stone dikes, on opposite sides of the creek entrance, with a total length of 680 feet, were constructed; 10,436 cubic yards of material, dipper measurement, was removed from the bar at the mouth of the creek, and one of the brush and stone dikes repaired. By the work done the improvement was completed, and no further appropriation is required.

The total amount expended to the close of the fiscal year ending June 30, 1903, was \$16,228.77, of which amount it is estimated that about \$870 has been expended for maintenance.

During the past fiscal year no work has been done in connection with this improvement. The amount expended was for examination of channel. The maximum draft of water that could be carried at mean low water on June 30, 1903, over the shoalest part of the locality under improvement is believed to be about 2.5 feet.

It is proposed to hold the available balance, \$771.23, for repairs, maintenance, and other contingencies.

The commerce of this creek consists of miscellaneous articles, such as sand, oysters, lime, coal, and lumber, and is principally of a local character. The value of the total freight movement for 1900 was \$438,900. No statistics have been received for 1902. The improvement has been of much benefit, at moderate cost.

July 1, 1902, balance unexpended	\$840.22
June 30, 1903, amount expended during fiscal year	68.99
July 1, 1903, balance unexpended	771.23

(See Appendix J 6.)

7. *Tuckerton Creek, New Jersey.*—This is a tidal stream flowing into Little Egg Harbor, on the Atlantic coast, northeast of Atlantic City. A preliminary examination and survey of the creek were made, and a report recommending its improvement, with estimate of cost, was submitted to Congress and is printed in House Document No. 274, Fifty-sixth Congress, first session; also in Annual Report of the Chief of Engineers for 1900, pages 1612–1615.

The present low-water depth at Tuckerton is 15 inches, which increases gradually to 4 feet at the mouth of the creek, a distance of 2 miles. From the mouth of the creek across the flats to Gaunts Point, three-fourths of a mile, the low-water depths are 2 to 2½ feet. The mean tidal range is 2½ feet. The existing project adopted by river and harbor act of June 13, 1902, contemplates the dredging of a channel 6 feet deep at mean low water and 80 feet wide from Gaunts Point, seven-eighths of a mile to the mouth of the creek; thence a channel of the same depth and 75 feet wide 1 mile to Parkers Landing; thence a channel of same depth and 60 feet wide five-eighths of a mile farther to West Tuckerton Landing; thence a channel 5 feet deep at mean low water and 60 feet wide for three-eighths of a mile to just about Scow Landing; and thence a channel 3 feet deep at mean low water and 40 feet wide for one-eighth of a mile to the milldam at Tuckerton, together with the widening of the channel at sharp bends, the channel across the cove between the mouth of the creek and Oyster Bed Point to be supplemented, if necessary, by a revetment wall along its northern side. The estimated cost of the work, including contingencies, is \$61,380.

The river and harbor act of June 13, 1902, appropriated \$12,000 for improving Tuckerton Creek, and contract has been made for dredging, the work to be completed in October next. Under this contract work was begun on May 5, 1903, and continued to the end of the fiscal year, when it was still in progress.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel to Tuckerton Landing was 2.5 feet; thence to point above Scow Landing 2 feet, and thence to the milldam at Tuckerton 1½ feet.

The amount expended on this improvement to June 30, 1903, is \$1,465.04.

The tonnage reported for last fiscal year is 14,297, valued at \$444,800.

July 1, 1902, balance unexpended	\$12,000.00
June 30, 1903; amount expended during fiscal year	1,465.04
July 1, 1903, balance unexpended	10,534.96
July 1, 1903, outstanding liabilities	1,452.02
July 1, 1903, balance available	9,082.94
July 1, 1903, amount covered by uncompleted contracts	8,400.00
{ Amount (estimated) required for completion of existing project	49,380.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 7.)

8. *Raccoon Creek, New Jersey*.—This creek rises in Gloucester County, flows in a northwesterly direction, and empties into the Delaware River at a point nearly opposite Marcus Hook, Pa. A preliminary examination and survey of Raccoon Creek was made in 1899, and a report, with estimated cost of improvement, was submitted to the Secretary of War under date of December 18, 1899, and printed in House Document No. 231, Fifty-sixth Congress, first session; also on pages 1590 to 1598, Annual Report of the Chief of Engineers for 1900.

It is navigable at high water for a distance of $1\frac{1}{2}$ miles above its mouth to Bridgeport for vessels of 9-foot draft, thence $3\frac{1}{4}$ miles farther to Springer's wharf for vessels drawing 7 feet, and thence $4\frac{1}{2}$ miles to Swedesboro, the head of steam navigation, for boats and barges having a draft of 4 feet. Above Swedesboro the stream is narrow, shoal, and very crooked. The navigable portion, when it leaves fast land, winds through meadows lying 2 or 3 feet above low water, which, except for the 2 miles immediately below Swedesboro, are generally protected from overflow by revetted earthen banks. Navigation is much obstructed by bars and a few sharp bends.

The average of tide at the confluence with the Delaware River is 6 feet; at Bridgeport, $1\frac{1}{2}$ miles above the mouth, it is also 6 feet; at Kirbys Landing, 3 miles above the mouth, 5.8 feet; at Davenport's wharf, $4\frac{1}{2}$ miles from the mouth, 5.6 feet; at Leap's wharf, $5\frac{1}{2}$ miles from the mouth, 5.6 feet; at Adolph Black's wharf, $7\frac{1}{4}$ miles above the mouth, 5.3 feet, while at Swedesboro it is 4.9 feet, though at the latter place it is considerably influenced by winds and freshets. The average rise and fall of the tides is about 6 feet at the mouth, 5.4 feet at Davenport's wharf, and 4.5 feet at Swedesboro.

The approved project adopted by river and harbor act of June 13, 1902, proposes the formation of a dredged channel 7 feet deep and 75 feet in width, at mean low water, from the mouth $1\frac{1}{2}$ miles to Bridgeport, thence a channel of the same depth and 60 feet wide to Springer's wharf, and thence a channel 5 feet deep at mean low water and 40 feet in width to the head of navigation at Swedesboro, $9\frac{1}{2}$ miles from its mouth, together with the widening of the channel around sharp bends, at an estimated cost of \$102,135.

The river and harbor act of June 13, 1902, appropriated \$15,000 for improving the creek, and contract has been made for dredging to the extent of the available funds in the lower 5 miles of the creek, the work provided for by the contract to be completed by October 31, 1903.

The amount expended on this improvement to June 30, 1903, is \$827.49.

The maximum draft that could be carried on June 30, 1903, at mean low water, over the shoalest part of the channel to Bridgeport, was 3 feet, and to Springer's 1.4 feet.

The commerce on the creek during the past calendar year is reported to have been 264,100 tons, valued at \$932,900, carried on by 10 steamers, 8 tugs, and 11 tow barges.

July 1, 1902, balance unexpended	\$15,000.00
June 30, 1903, amount expended during fiscal year	827.49
July 1, 1903, balance unexpended	14,172.51
July 1, 1903, outstanding liabilities	24.53
July 1, 1903, balance available	14,147.98
July 1, 1903, amount covered by uncompleted contracts.....	13,500.00
{ Amount (estimated) required for completion of existing project	87,135.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 8.)

9. Wilmington Harbor, Delaware.—The harbor of Wilmington, Del., is in the Christiana River, and includes a length of about 4 miles above its mouth at the Delaware River. It also includes the navigable portion of the Brandywine River, which flows into the Christiana River at a point about $1\frac{1}{2}$ miles above its mouth.

Previous to 1836, when the first appropriation for the improvement of the Christiana River was made, the low-water depth at the entrance to this stream was about $8\frac{1}{2}$ feet. The minimum depth in the channel in the portion of the river below Third Street Bridge, Wilmington, was 8 feet. This depth was increased in 1836 by dredging to 10 feet below low water.

The present project is based upon a survey made in 1895 (see Annual Report of the Chief of Engineers for 1896, pp. 974 to 998), and provides for the formation by dredging, rock removal, and construction of dikes of a channel in the Christiana River 21 feet deep at mean low water from that depth in the Delaware River to the pulp works, a distance of about 4 miles, and thence diminishing to a depth of 10 feet at mean low water to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, the width at bottom varying between 250 feet at the mouth and 200 feet at bridge No. 4. The project further provides for the removal of shoals from bridge No. 4 to Newport, to a depth of 7 feet at mean low water. The width made under the present project is 200 feet from the pulp works to the mouth of the Brandywine, and thence to the 21-foot contour in the Delaware River 250 feet, except a stretch of about 1,750 feet extending up from a point opposite the light-house at the mouth, where the width was made only 200 feet. The depth made was 21 feet, and over the rock ledges above and below Third Street Bridge about $21\frac{1}{2}$ feet.

A history of the improvement and the work done under this and previous projects will be found in the Annual Report of the Chief of Engineers for 1901, pages 246 to 249.

The last work done on the improvement was in 1901. During the past fiscal year a survey was made of the river extending from the 21-foot contour in the Delaware River to the draw pier of the Philadelphia, Baltimore and Washington Railroad cut-off bridge No. 4, and report thereon, with maps, was submitted to the Chief of Engineers under date of March 26, 1903. The expenditures were for outstanding liabilities, cost of survey, etc.

The amount expended on the improvement of this river from 1836 to June 30, 1903, is \$845,355.22, of which \$443,217.10 is on the present project.

The survey made late in the fall of last year shows a channel 21 feet deep at mean low water, and ranging from 25 to 150 feet in width from the mouth to about 1,500 feet above the Third Street Bridge, broken by two shoals, aggregating 2,000 feet in length, on which the depths are but 16 feet. Above this, at the Pusey & Jones Company's wharves, the depth was 12.5 feet, and in the vicinity of the pulp works the depth was 11.5 feet. Between these two last-named points the depth ranged between 15 and 20 feet.

The maximum draft that can be carried (June 30, 1903) at mean low water over the shoalest part of the channel under improvement, between the Delaware River and the pulp works, is 11.5 feet.

The river and harbor act of June 13, 1902, provides as follows:

Improving Wilmington Harbor, Delaware: Continuing improvement and for maintenance, fifty thousand dollars: *Provided*, That not more than twenty-five thousand dollars of said sum shall be expended until arrangements have been made by the city of Wilmington, and approved by the Secretary of War, to dispose of the sewage from the city in such manner as to prevent the filling of the channel, and the largely increased cost of maintenance caused thereby.

At the close of the fiscal year a project for the expenditure of the available funds was under consideration.

The tonnage and value of the leading articles shipped to and from the port of Wilmington in the year 1902, as reported by the board of trade, was 829,606 tons, valued at \$35,227,455. The foreign commerce amounted to \$4,350,500 additional, and the shipbuilding industry is quite extensive.

July 1, 1902, balance unexpended	\$60,654.60
Proceeds of sale of river and harbor property.....	210.00
	60,864.60
June 30, 1903, amount expended during fiscal year	2,969.04
July 1, 1903, balance unexpended	57,895.56
July 1, 1903, outstanding liabilities	8,000.00
July 1, 1903, balance available	49,895.56
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 9.)

10. *Appoquinimink, Murderkill, and Mispillion rivers, Delaware.*—

(a) *Appoquinimink River.*—At the time of the adoption of the present project there was a mean low-water depth of 2 feet at the entrance into Delaware Bay, and the shoalest depth inside the river was 4½ feet. The most serious obstructions to the navigation of the river were the many bends in the lower and middle sections.

The approved project is based upon a survey made in 1889, and provides for a channel 8 feet deep at mean low water, having a width of 80 feet from the bridge at Odessa, the head of navigation, to near Townsend's wharf, a distance of 3¼ miles, and a width of 100 feet from this wharf to the mouth of the river, a distance of 5 miles. The estimated cost of the improvement is \$39,963.

In 1891 the channel was dredged to the full width of 80 feet and depth of 8 feet at mean low water for a distance of 1,975 feet in a down-river direction, beginning at the lower end of Watkin's wharf, at

Odessa, and early in 1893 a further distance of 4,487 feet was dredged. Of the latter, 595 feet was dredged to the approved width, but on account of the settlement and sliding in of the very soft marsh bank upon which the excavated mud and sand were deposited the full approved width of 80 feet could not be made along the remaining 3,892 feet, and it was therefore made only 50 feet until the banks should become firmer. The entire length dredged was 6,462 feet, of which 2,570 feet is 80 feet wide and 3,892 feet is 50 feet wide. The channel was thereby materially improved as far as the work had progressed, giving great relief to the shipping and increased harbor room at Odessa.

During the fiscal year 1898-1899 the channel was dredged and shoals removed to a width of 50 feet and a depth of 8 feet at mean low water, as follows: At the upper point of and through Quarter Mile reach; from just below Polk's wharf to above the lower corner of the steamboat wharf at Odessa; in Windmill reach and Toms Bay reach; below Windmill reach and in the reach just above the one leading to New Bridge; the cut-off at No Mans Friend reach was widened to from 60 to 70 feet through the straight portion of it, and still more at the ends, which were made fan shape; a cut-off 625 feet in length was made through the marsh at Thomas Landing, and another, 960 feet long, including approaches, through the marsh just below. An average width of 45 feet and a low-water depth of 6.8 feet in the upper and 6.5 feet in the lower cut-off were obtained, with a low-water depth of 8 feet over a width of about 30 feet extending through both cut-offs. The aggregate length of dredging done in these operations was about 8,000 feet. At the mouth of the river a cut 30 feet wide and 5 feet deep at mean low water was made for a length of 1,100 feet through the marsh from the 5-foot curve of depth inside the river to the 5-foot curve of depth in the slough outside, through which deep water in the Delaware River is reached just below Blackbird Creek.

In the early part of 1900 the two cut-offs at Thomas Landing were dredged to a width and depth of not less than 80 feet and 8 feet at mean low water, respectively; at the mouth of the river the cut across the marsh was widened to 100 feet, the depth made being not less than 5 feet at mean low water; and at Toms Bay a cut 380 feet long was made through a sharp turn in the river, the width and depth made being not less than 35 feet and 6 feet at mean low water, respectively.

The river and harbor act of June 13, 1902, appropriated \$15,000 for the Appoquinimink, Murderkill, and Mispillion rivers, for maintenance. Of this amount, \$3,000 was allotted to this improvement and was applied to dredging. The range of the tide is about 6 feet at the mouth of the river.

The maximum draft that could be carried June 30, 1903, at mean low water, over the shoalest part of the channel in the river was 5½ feet and over the bar at the mouth 2 feet.

The amount expended upon the project to June 30, 1903, was \$27,779.19, of which \$2,779.19 was for maintenance.

The commerce in the river for the past year is reported to have been 30,845 tons, valued at \$1,787,050, as against 19,132 tons, valued at \$980,975 in 1891, shortly after the improvement of the river was begun.

(b) *Murderkill River*.—This river is a tidal stream and a tributary of Delaware Bay, and flows through Kent County, Del. Its navigable portion is about 9 miles long. The condition of the river was

fair for the greater part of its length, the average width and depth being 90 and 6 feet, respectively. Outside the junction with Delaware Bay, however, there was a serious obstruction—the flats, which are nearly bare at low tide and extend for nearly a mile from the shore. The average rise and fall of the tide at the mouth is 4.6 feet.

In 1881 an examination of this river was made and a project submitted for its improvement. No appropriation was made by Congress, however, as the river was at that time in the hands of an improvement and navigation company chartered by the State. This company had expended about \$10,000 in rectifying the many bends of the river by cutting straight canals and in dredging a narrow cut across the flats at the mouth. The latter slowly filled up again.

The project for improvement adopted in 1892 is for a 7-foot low-water channel 80 feet wide from the town of Frederica, at the head of navigation, to the mouth of the river, and 150 feet wide from the mouth across the flats outside to the 7-foot curve of depth in Delaware Bay, the cut at the mouth to be protected by forming an embankment of the dredged material on each side, the estimated cost being \$47,550.

In 1893 a channel was dug to a depth of 5 feet below mean low water across the flats from a short distance inside the river to the 5-foot curve of depth in Delaware Bay, and in 1895 a cut-off 975 feet long was made at Lower Landing, about 4 miles from the mouth, and shoals were dredged at a sharp turn in the river below Frederica, at the head of Long Canal, at Coles shoal, and just inside the mouth of the river.

The width of the cut in every case was 40 feet and the depth 7 feet at mean low water. In the winter of 1896-97 a channel was dredged 60 feet wide and 6 feet deep at mean low water from the 6-foot curve in Delaware Bay to the steamboat wharf inside the river, a distance of 4,700 feet, and shoals just above the steamboat wharf, at Broad reach and Webbs Landing, aggregating 2,484 feet in length, were dredged to a width of 40 feet and a depth of 6 feet, resulting in an unobstructed low-water channel 6 feet deep from that depth in Delaware Bay to Lindells shoal, a distance of 16,000 feet; and in 1899 shoals at the steamboat wharf at Frederica and 500 feet below, at Long reach, Bradleys Canal, Goodwins, and Lower Landing, aggregating about 4,000 feet in length, were dredged to a width of 40 feet and a depth of 6 feet at mean low water, and at the mouth the channel was dredged to a width of 60 feet and a depth of 6 feet at mean low water to that depth in Delaware Bay, resulting in a channel 6 feet deep at mean low water, and from 40 to 60 feet wide from the head of navigation at Frederica to Delaware Bay.

The river and harbor act of June 13, 1902, appropriated \$15,000 for the Appoquinimink, Murderkill, and Mispillion rivers, for maintenance. Of this amount \$2,000 was allotted to Murderkill River, and was applied to dredging certain shoals.

The amount expended upon the project to June 30, 1903, was \$25,384, of which \$2,000 was for maintenance. The sum of \$1,500 from the appropriation of August 18, 1894, was expended, in accordance with the terms of the appropriation, in removing a shoal at the mouth of the St. Jones River.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part in the river is $4\frac{1}{2}$ feet, and across the mouth 4 feet.

The commerce of this river, which is quite varied, is reported for

the past calendar year as 21,253 tons, valued at \$887,650, and was carried on by 1 steamer and about 20 sailing vessels.

(c) *Mispillion River*.—This river is a tidal stream which enters Delaware Bay about 17 miles northwest of Cape Henlopen. It is navigable for about 12 miles. The mouth of the river is greatly obstructed by a flat foreshore without a channel. Vessels can enter and depart only at high water, the tidal range being about 4 feet.

The river from Milford to the mouth was improved by the General Government between the years 1879 and 1889, and \$17,000 was expended in making a channel 40 feet wide and 6 feet deep at mean low water.

The project for the improvement at the mouth of the river, proposed in a report on a survey made in 1891, provides for a cut across the flats in a southeasterly direction, having a width of 150 feet and a depth of 6 feet at mean low water, beginning opposite the lighthouse and ending in deep water in the bay, the cut to be protected on the upper or north side by a bank made of the excavated material. The estimated cost is \$24,000.

In 1893 operations were begun under the project, and at the close of work in that season a pile dike 500 feet long had been built on the north side of the mouth along the line of the channel, and a channel 80 feet wide and 5 feet deep at mean low water had been dredged for a length of 570 feet, extending from the 5-foot curve of depth in the Mispillion River to a point opposite and 50 feet west from the outer end of the dike, and in 1895 and 1896 a channel was dredged 75 feet wide and 6 feet deep at mean low water from inside the river just above Sandy Point to opposite the mouth of Cedar Creek, and a crib dike 350 feet in length, flanking the new channel on the west side, was built. The dikes were found necessary during the progress of the dredging, owing to the character of the material dredged, which was mainly treacherous sand.

In 1897 a brush and stone extension to the pile dike was built for a length of 200 feet, and a cut 50 feet wide and 6 feet deep at mean low water was dredged over a length of 450 feet near the end of the crib dike, but was soon obliterated during severe storms. A channel 4 feet deep at mean low water and 40 feet wide was then dredged across the Bulkhead shoal, about 400 feet beyond the mouth, resulting in a continuous channel 4 feet deep from inside the river across the Bulkhead shoal, and in 1899 a single pile jetty was built for a length of 141 feet, extending from the inner end of the old pile and brush jetty, northward to the high-water line of the Mispillion River, and a similar jetty was constructed from Green Point, due east, for a length of 206 feet. The latter, which is designed to direct the waters of Cedar Creek into the Mispillion currents, was to extend much farther out, but it was found necessary to reduce its proposed length by about one-half, thus permitting the use of the old channel down the bay shore, as a break through a cut made at the mouth by private parties in 1898, under authority of the War Department, had damaged the channel in the route of the original project to deep water in Delaware Bay.

In 1901 the crib dike built in 1895, having been undermined and become unserviceable, was removed. In the same year a survey of the river was made, under the provisions of the emergency river and harbor act of June 6, 1900. The report on this survey is printed in

House Document No. 102, Fifty-sixth Congress, second session, and also in Appendix H 24 of Annual Report of the Chief of Engineers for 1901. The improvement therein recommended is the formation of a channel 6 feet deep at mean low water and 60 feet wide, widening to 75 feet at sharp turns from Milford to the mouth, and thence a channel 4 feet deep at mean low water and 150 feet wide across the flats at the mouth to the 4-foot curve in Delaware Bay; the channel at the mouth to be protected by a jetty on the south side 5,000 feet long, the total cost being estimated at \$87,065.

The river and harbor act of June 13, 1902, appropriated \$15,000 for the Appoquinimink, Murderkill, and Mispillion rivers, for maintenance. Of this amount \$10,000 was allotted to this improvement, and the project approved for its expenditure provides for dredging at the mouth of the river and the construction of a jetty on the northeasterly side of the channel across the bar.

Dredging was begun on October 16, 1902, and on May 21, 1903, work was begun on the construction of the jetty.

The amount expended on the improvement to June 30, 1903, was \$44,727.34. Of this amount \$17,000 was on a former project and \$27,727.34 on the present one, including \$3,389.29 expended for maintenance.

The maximum draft that could be carried on June 30, 1903, at mean low water over the shoalest part of the bar at the mouth was 2½ feet.

The commerce on the river for the past calendar year is reported to have been 57,340 tons, valued at \$1,565,340, which is quite a reduction from the average of several years past; that reported for 1890, ten years after the first improvement was begun, was 44,315 tons, valued at \$916,250.

July 1, 1902, balance unexpended	\$15,389.10
June 30, 1903, amount expended during fiscal year	7,257.31
July 1, 1903, balance unexpended	8,131.79
July 1, 1903, amount covered by uncompleted contracts	7,200.00
(Amount (estimated) required for completion of existing project	42,727.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	18,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 10.)

11. *Smyrna River, Delaware.*—This river was formerly known as Duck Creek. It is a tidal stream flowing easterly into the Delaware River at a point about 26 miles south of Wilmington, Del. The navigable portion of the river was originally about 9 miles long; the minimum mean low-water depth over shoal places was 2½ feet in the river and 4 feet at the bar where it enters the Delaware River. The mean range of the tide at the mouth is nearly 6 feet.

In 1878 a project was made for the improvement of the whole river, including the channel across the bar at the mouth. By direction of Congress the improvement of the bar was commenced first, and during the following four years three appropriations, aggregating \$10,000, were expended in dredging a channel 100 feet wide and 8 feet deep at mean low water across the bar. The dredged channel soon filled up again.

A new project was adopted in 1887 with a view of obtaining a channel of 7-foot depth throughout, with a width of 60 feet in the river and 100 feet at the bar, the channel over the bar to be protected by a stone jetty. The estimated cost of the improvement was \$90,698.40. The first appropriation for work on this project was in 1888, and was for dredging. The subsequent appropriations for continuing the improvement have also been applied to dredging.

The total expenditure to June 30, 1903, was \$42,983.93, of which \$32,983.93 was on the present project.

The entire length of channel has been dredged, in parts at various times between 1888 and 1900, to the approved dimensions, except at the mouth of the river.

No work of improvement was done in the past fiscal year. The expenditure was for examination of river.

Under the provisions of the emergency river and harbor act of June 6, 1900, a preliminary examination and survey were made with a view to securing two crosscuts to shorten the distance between the head of navigation on this river and Delaware Bay. The report on the survey is printed in House Document No. 90, Fifty-sixth Congress, second session, and on pages 1363-1364, Annual Report of the Chief of Engineers for 1901. It recommends the construction of two cut-offs 60 feet wide and 7 feet deep at mean low water, one 2,445 feet long, extending from the turn just below Limekiln wharf to the turn just above Mill Creek; the other 2,200 feet long, extending from below Rothwells Landing to the turn between Deep Hole and Brick Store Landing. The cost of work was estimated at \$15,000, and that amount was appropriated for the purpose by the river and harbor act of June 13, 1902. Upon further examination, however, it was found that a modification of the plan by the substitution for the present lower cut of a cut from the mouth of Mill Creek to the bend above Brick Store Landing would be a material improvement, and action in the matter has therefore been deferred to await further action by Congress.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel in the river is 5 feet and over the bar at the mouth 3 feet.

The commerce in the river is reported for the past year to have been 430,236 tons, of a valuation of \$3,455,469. Before the improvements were begun the tonnage reported was 204,706, and the valuation \$1,944,000.

July 1, 1902, balance unexpended	\$15,252.46
June 30, 1903, amount expended during fiscal year	236.39
July 1, 1903, balance unexpended	15,016.07

(Amount (estimated) required for completion of existing project	4,365.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 11.)

12. *Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Leves, Del.*—The original project, based on a survey made in 1884, contemplated the construction of a continuous waterway 70 feet wide and 6 feet deep at mean low water from Chincoteague

Inlet at the southwesterly end of Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Del. The entire length of the proposed channel is nearly 73 miles, of which about 57 miles is through several shallow interior bays separated from the Atlantic Ocean by narrow strips of sandy beach and soil; the remaining 16 miles to consist mainly of canals to be formed by dredging.

The estimated cost was \$350,000.

In 1892 the line of location was slightly modified and the proposed dimensions of the canal were reduced from a width of 70 feet to 20 feet on the bottom. The estimated cost from Rehoboth to Delaware Bay was reduced to \$241,224. This, however, supposed that the work would be done in about two years in one large contract.

A cut has been made 4 miles long, 20 feet wide at bottom, and 4 feet deep below the mean level of Assawaman Bay across the neck of land lying between Little Assawaman Bay and Whites Creek, a tributary of Indian River Bay, and three temporary wooden bridges built over it. A cut 20 feet wide and 6 feet deep below datum (mean low water at the Delaware Breakwater in Delaware Bay) has been made from that depth in Rehoboth Bay to a point 1,250 feet south of the Delaware, Maryland and Virginia Railroad crossing at Rehoboth, a distance of 9,000 feet; and another cut, in continuation of this, extending to the railroad reservation, a distance of 1,125 feet, has been made to a depth of 2 feet below mean low-water level; and north of the railroad crossing a cut was made to a point 1,000 feet north of the boundary of the railroad track. Of this latter distance, the lower 800 feet was excavated to a depth of $9\frac{1}{2}$ feet and the remaining 200 feet to an average depth of 15 feet above datum, the depth of cutting in the first averaging approximately $17\frac{1}{2}$ feet, and in the latter about 8 feet. The cut between Assawaman Bay and Whites Creek was made and the three bridges built in 1891. The remainder of the work described was done between 1893 and February, 1896.

The river and harbor act of June 3, 1896, appropriated \$25,000 for continuing this improvement, to be used between Delaware Bay and Indian River, but provided that no part of the appropriation should be expended until the right of way should be secured without cost to the United States. The right of way over or through any railroad or county bridge was, however, not subjected to the proviso, but might be secured by condemnation proceedings. Previous to the passage of this act deeds to the land covering the entire right of way had been vested in the United States, with the exception of that portion crossing the Delaware, Maryland and Virginia Railroad at Rehoboth.

In January, 1899, the commissioners of Rehoboth conveyed to the United States a quitclaim deed to whatever title that corporation had to the land at the railroad crossing. The railroad, however, held the right of way by a franchise from the State.

In May, 1899, the commissioners for condemnation of the right of way of the Delaware, Maryland and Virginia Railroad Company at Rehoboth awarded the sum of \$37,343.58 to the railroad company as being in full for all damages to them and for the erection and maintenance of a bridge across the waterway. No funds have thus far been made available for the payment of this award. No action has, therefore, been taken toward the construction of the bridge by the railroad company.

The proviso restricting the expenditure of the appropriation of June

3, 1896, having been construed by the law officers of the Department to apply only to that portion of the right of way secured without cost to the United States, the unexpended funds were held to be available for work under the existing project, and on April 7, 1902, a contract was made for construction of two parallel jetties of stone and brush, and for dredging, the work to be completed by October 31, 1902. This time was extended, the work under the contract not being begun until September 16, 1902. To the end of the fiscal year the jetties had been completed and the canal north of Rehoboth Bay had been dredged where required, and some dredging done in Rehoboth Bay at the mouth of the canal.

The amount expended on this improvement to June 30, 1903, was \$186,311.38, of which \$17,899.50 was for maintenance.

No statistics as to commerce have been obtained. A small steamer has recently begun to ply between the railroad crossing at Rehoboth and Bethany Beach.

July 1, 1902, balance unexpended	\$25,328. 12
June 30, 1903, amount expended during fiscal year.....	17,899. 50
July 1, 1903, balance unexpended	7,438. 62
July 1, 1903, outstanding liabilities	253. 81
July 1, 1903, balance available.....	7,184. 81
July 1, 1903, amount covered by uncompleted contracts.....	6,600. 00
{ Amount (estimated) required for completion of existing project	" 181,250. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	60,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 12.)

13. *Elk River, Maryland.*—Before improvements were commenced there was practically no navigation above Cedar Point. The original project, dated July 17, 1874, was for a channel 6 feet deep at low water, or 8 feet at high water, from Cedar Point to Elkton, the head of navigation, and in the Little Elk as far as Bennett's wharf. The mean range of the tide is 2 feet. Such a channel was estimated to cost \$36,000 if 75 feet wide, and about \$25,000 if 50 feet wide, cheap dikes being required for regulating the banks, and to provide a place behind which to deposit the material dredged from the shoals. The first work was done in 1874, when \$5,000 was expended in building a dike and dredging to a width of 25 feet and a depth of 6 feet at mean low water in front of it and for about 300 feet below. Two years later the channel was made 40 feet wide from the bridge at Elkton to about one-half mile below. In 1884 a channel was completed 80 feet wide through the bar near the mouth of the Little Elk River, and 70 feet wide thence to the bridge at Elkton, the depth being 7 feet at mean low water. In 1893 a channel 100 feet wide and 8 feet deep from deep water below Cedar Point to the bridge at Elkton was completed. The expenditure on the original and subsequent projects has amounted to \$46,500.

The channel had shoaled, and in a report on a survey made in 1899 (Annual Report of the Chief of Engineers for 1901, pp. 1668-1669) it was proposed to restore the channel to 8 feet deep at mean low water,

^a Exclusive of \$37,343.58, award for right of way through Delaware, Maryland and Virginia Railroad.

and 100 feet wide, from deep water below Cedar Point to the bridge at Elkton, at an estimated cost of \$16,665, with an annual cost of \$2,500 for maintenance. The river and harbor act of June 13, 1902, adopted this project and appropriated \$16,665 for the work. This appropriation was expended in dredging. The project width of 100 feet could not be made, as the river was found to have shoaled very much since the survey in 1899, on which the present appropriation was based. To complete the project will require the removal of about 40,000 cubic yards of material. The amount expended on this improvement to June 30, 1903, is \$61,564.33, of which \$46,500 was on previous projects. The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the river is 5½ feet.

The commerce of the river for the year 1902 is reported to be 17,389 tons, valued at \$116,610; 22 barges of an average of 900 tons and other other vessels were built during the year.

July 1, 1902, balance unexpended.....	\$16,665.00
June 30, 1903, amount expended during fiscal year.....	15,064.33

July 1, 1903, balance unexpended.....	1,600.67
---------------------------------------	----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	2,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 13.)

14. *Susquehanna River above and below Havre de Grace, Maryland.*—The original governing depth was 5 feet at mean low water. The mean range of tide is 2½ feet. The channel above Havre de Grace was narrow and one cause of ice gorges. The original project is dated February 22, 1853, and was for a channel 12 feet deep and 100 feet wide, at an estimated cost of \$59,000. Improvements have been in progress since 1853, and up to August 22, 1882, when the existing project was adopted, \$97,390 had been expended upon them. The existing project is to give a channel 15 feet deep at mean low water below Havre de Grace and to remove the shoal opposite Watson Island (which is above Havre de Grace) to a depth of 8 feet at the same stage of the tide, at an estimated cost of \$168,000. The amount expended on that project to June 30, 1903, is \$64,897.96, and resulted in dredging a channel below Havre de Grace to a depth of 12 feet and in partially removing the shoal near Watson Island. No work has been done since 1889. A survey has been made during the past fiscal year and \$10,000 was appropriated by the river and harbor act of June 13, 1902, for continuing the improvement above and below Havre de Grace.

It is proposed to apply the appropriations of former years, which are restricted to expenditure to the part of the river above the Philadelphia, Baltimore and Washington Railroad bridge, to dredging above Havre de Grace and the removal of some rock in the channel near Port Deposit; and with the \$10,000 appropriated in 1902 to dredge a channel 15 feet deep at mean low water from a point near the Havre de Grace light-house to the head of Spesutie Island, making the channel as wide, not exceeding 200 feet, as available funds will permit. Proposals for dredging have been invited, and it is expected that the work covered thereby will be completed the coming fall.

The maximum draft that can be carried June 30, 1903, at mean low

water, over the shoalest part of the channel under improvement, is 10 feet.

It has been impracticable to obtain complete commercial statistics, but it is reported that there are annually 150 to 200 boats of various kinds carrying 75,000 to 100,000 tons quarry stone and phosphate using the Susquehanna River at and below Port Deposit.

July 1, 1902, balance unexpended	\$19,734.05
June 30, 1903, amount expended during fiscal year	1,132.01

July 1, 1903, balance unexpended	18,602.04
--	-----------

Amount (estimated) required for completion of existing project	84,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	12,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix J 14.)

15. *Harbors at Rockhall, Queenstown, Claiborne, and Cambridge, and Chester, Choptank, Warwick, Pocomoke, and Wicomico rivers, and Tyaskin (Wetipquin) Creek, Maryland.*—(a) *Rockhall Harbor and inner harbor at Rockhall.*—In 1894 the controlling depth was 5 feet, with an average range of tide of 1.1 feet. With \$16,600, appropriated June 3, 1896, a project was carried out in 1897–98 by dredging a cut 80 feet wide and 10 feet deep at mean low water from the 10-foot curve in Swan Creek Inlet to the 10-foot depth in Chesapeake Bay, and a channel 100 feet wide and 10 feet deep from that depth in Swan Creek Inlet to the old pier at Rockhall. A turning basin, embracing the old and new piers, was also dredged.

In accordance with the river and harbor act of March 3, 1899, an examination was made of Rockhall Harbor and the inner harbor at Rockhall, report upon which will be found in House Document No. 99, Fifty-sixth Congress, first session, and in Annual Report of the Chief of Engineers for 1900, pages 1670–1672. The project therein proposed is the dredging of a channel 12 feet deep and 150 feet wide from Chesapeake Bay to Swan Creek Inlet, across Swan Point bar, and 12 feet deep and 150 feet wide from Swan Creek Inlet to the wharf at Rockhall, at an estimated cost, in 1899, of \$43,065, and \$9,208 every two years for maintenance.

The river and harbor act of June 13, 1902, adopted this project and appropriated \$74,000 for dredging certain harbors and rivers on the easterly shore of Chesapeake Bay. The sum of \$12,000 was allotted for this improvement, the available sum to be applied to the dredging of a channel 12 feet deep and as wide as practicable within the project limits from Swan Creek Inlet to the wharf at Rockhall. Contract for dredging on this and the other improvements on the easterly shore of Chesapeake Bay has been made, under which the entire work is to be completed by December 31, 1903.

The amount expended on this improvement to June 30, 1903, is \$16,747.31, of which \$16,597.12 was on a previous project. In addition to these sums, \$2.88 was returned to the Treasury under the previous project.

The maximum draft that could be carried on June 30, 1903, at mean low water over the shoalest part of the channel across Swan Point bar

is about 4 feet and in the inner harbor 7 feet. From 50 to 60 vessels of from 5 to 50 tons make this harbor their headquarters, and 2 steamers make a daily service from Baltimore.

(b) *Queenstown Harbor*.—Before 1871 the controlling depth in this harbor was 6 feet. Between that year and 1880 it was improved under a project submitted in 1871, and a channel 100 feet wide at bottom and 8 feet deep at mean low water was made. In 1897, with \$5,000 appropriated for continuing the improvement, the channel was dredged to a depth of 8½ feet at mean low water and 100 feet wide from Chester River to the inner harbor; and in 1900 a shoal extending from a point 138 feet above the lower light down for a distance of 950 feet was dredged to a depth of 8 feet and a width of 80 feet.

Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for dredging certain harbors and rivers on the easterly shore of Chesapeake Bay, the sum of \$12,000 was allotted to Queenstown Harbor. The act provides that the improvement shall be made in accordance with the report submitted in House Document No. 92, Fifty-sixth Congress, first session, which is also printed in the Annual Report of the Chief of Engineers for 1900, pages 1673–1676. The project therein submitted contemplates increasing the dimensions of the channel so as to make them 10 feet deep and 200 feet wide, at an estimated cost of \$23,100. The range of tide is about 2 feet.

With the allotment the entire length of channel is proposed to be dredged to a depth of 10 feet and as wide as practicable within the project limits. To the close of the fiscal year a length of about 740 feet in the outer section of the channel leading to Queenstown Harbor, from the 10-foot curve in Chester River, had been dredged to a width of 100 feet, and two additional cuts, inward, of an aggregate length of 1,080 feet, had been dredged to a width of 30 feet, the depth made being 10 feet at mean low water.

The amount expended on this improvement to June 30, 1903, is \$21,012.52, of which \$2,012.52 was on the present project.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the locality under improvement was 6 feet.

Queenstown Harbor is the terminus of the Queen Anne's Railroad Company.

The tonnage of the harbor is reported to be as follows:

	Tons.
1900.....	12, 373
1901.....	11, 328
1902.....	18, 769

(c) *Claiborne Harbor*.—Claiborne is on the eastern shore of Eastern Bay, an estuary of Chesapeake Bay, about 6 miles east from Bloody Point light-house. No improvement there has ever been made by the United States. The controlling depth is 9 feet at mean low water, with a mean range of tide of 2 feet. The sum of \$15,000 was allotted to this improvement from the \$74,000 appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the easterly shore of Chesapeake Bay, Maryland. The act contains the proviso respecting Claiborne Harbor that the improvement shall be made in accordance with the report submitted in House Document No. 81, Fifty-sixth Congress, first session. The report referred to is also printed in the Annual Report of the Chief of Engineers for 1900,

pages 1677-1681, and provides for dredging a channel 12 feet deep at mean low water and 300 feet wide from the 12-foot contour in Eastern Bay to the railroad pier in the harbor, a distance of about 1,900 feet, and thence shoreward along the south side of the pier to a width of 195 feet for a length of 500 feet, at an estimated cost of \$17,490, and a further sum of \$2,500 for an extension of the existing jetty, should it be found necessary.

It is proposed to apply the allotment to dredging the channel to a depth of 12 feet and as wide, within the project limits, as the available funds will permit; and a contract has been made for the dredging at this and other eastern shore improvements, the entire work to be completed by December 31, 1903.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel is 7 feet.

No work was done on this improvement during the past fiscal year. The amount expended to June 30, 1903, is \$68.50, which was for an examination.

Claiborne Harbor is the western terminus of the Baltimore, Chesapeake and Atlantic Railway. Two steamers and 50 sailing vessels and barges are reported to ply in the harbor.

(d) *Cambridge Harbor*.—This harbor is on the eastern side of the Choptank River, about 20 miles above its mouth. In 1870, before operations were commenced, there was a controlling depth of 4 feet. The improvement of the harbor was commenced in 1871 with a project submitted in March of that year for an entrance way of 100 feet in width and to provide sufficient harbor accommodations of a depth of 10 feet at mean low water. The estimated cost was \$36,000. Ten thousand dollars was appropriated March 3, 1871, and work begun. On this and succeeding projects \$50,237 was expended to June 30, 1896, resulting in a channel 150 feet wide and 12 feet deep at mean low water from that depth in the Choptank River to the railroad wharf, a distance of nearly a mile. The inner harbor below the bridge had been dredged over its whole irregular area to a depth of 10 feet, and the part of the harbor above the bridge, for a distance of 750 feet, had been dredged to a depth of 8 feet and a width of 215 feet. A survey was made in 1896, and the improvements then recommended were for a 12-foot low-water channel 150 feet wide from the 12-foot curve in the Choptank River to a point 500 feet outside the Baltimore, Chesapeake and Atlantic Railway Company's steamboat wharf, and from this point gradually widening to the harbor line at the wharf; from the steamboat wharf to Mill wharf, to increase the width an average of 200 feet with a depth of 8 feet, making an anchorage basin; increasing the width of the lower harbor 40 feet on the north side and widening the upper harbor an average of 360 feet along the channel already dredged to a depth of 8 feet. The estimated cost of the project is \$8,120.

Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the easterly shore of Chesapeake Bay, \$3,000 has been allotted to this improvement, and this amount it is proposed to apply to an extension of the 8-foot channel farther up the harbor inside of the drawbridge, the width to be 150 feet; and contract for the dredging has been made, to be completed by December 31, 1903.

The amount expended on this improvement to June 30, 1903, is \$50,301.50, of which \$50,237 was on previous projects.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel below the bridge was 10 feet, and about 8 feet above as far as the channel has been dredged. The range of the tide is about 1.7 feet.

The tonnage for the past calendar year is reported to be 85,991, valued at \$1,355,733, and is carried on by 6 steamers and 98 sailing vessels and barges.

(e) *Chester River, Maryland, from Crumpton to Jones Landing.*—Before operations were undertaken vessels at low tide drawing 6 feet of water could reach Crumpton, 33 miles above the mouth, and from that point to Jones Landing, 6½ miles, the controlling depth was 3 feet with a mean range of tide of 1.2 feet. The project for improvement, adopted October 21, 1890, is for a 6-foot low-water channel from Crumpton to Jones Landing, at an estimated cost of \$12,750, increased in 1896 to \$14,250, and still later to \$19,562.50. There has been but one project for this river. By June 30, 1900, the projected channel had been brought to within less than a half mile of Jones Landing by dredging. Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the easterly shore of Chesapeake Bay, Maryland, \$5,402 was allotted for Chester River for continuing the improvement, and this was applied to dredging, mainly at the upper end of the river.

The amount expended on this improvement to June 30, 1903, is \$19,136.30, of which about \$2,500 was for maintenance.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part in the river was 5 feet.

The commerce of the river consists mainly of agricultural products. No complete statistics have been obtained, but the steamboat line plying on the river reports its business for the year as 47,512 tons, valued at \$1,859,299.

(f) *Choptank River, Maryland.*—Before improvements were begun, in 1879, the depth of water in the channel between Denton and Greensboro varied from 2 to 8 feet at low water, with a mean range of tide of about 2 feet. Navigation, carried on by small sailing vessels, extended only to 3 miles above Denton. Upon the remaining 5 miles to Greensboro, the head of navigation, all freight had to be transported upon scows.

A project for improvement was made in 1880 for an 8-foot low-water channel 75 feet wide, at an estimated cost of \$79,000, and up to the year 1897 a channel had been made not less than 75 feet wide and 7½ feet deep between Greensboro and Brick Mills, a distance of about 4 miles, and to a width of 75 feet and a depth of 8 feet for a further distance of 1,800 feet below the Brick Mills. The remaining distance to Denton had been partly improved by dredging the channel where needed to depths of 5 and 6 feet and by widening it to about 40 feet.

In 1898–99 a cut 40 feet wide was dredged between the bridge at Greensboro and a point 1,130 feet below, at which point dredging in an up-river direction had stopped in previous operations, and several shoals from 10 to 30 feet wide, and aggregating 830 feet in length, were dredged to the approved depth; and at Brick Mills the channel was dredged for a length of 1,000 feet to a width of 65 feet. The depth made in these operations was 8 feet at mean low water, and in 1899–1900 the channel was dredged to the approved dimensions, 75 feet wide and 8 feet deep at mean low water, from the railroad bridge

above Denton to the Brick Mills, and from Greensboro in a down-river direction a distance of 4,760 feet, and a turning basin was dredged at Greensboro. This left a stretch of about 1,600 feet, previously dredged to 7 feet, to be dredged to an 8-foot depth, and the restoration of the channel where it had shoaled, to complete the project.

Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for dredging certain harbors and rivers on the easterly shore of Chesapeake Bay, the sum of \$3,000 was allotted for continuing the improvement of this river by dredging.

The maximum draft that could be carried on June 30, 1903, at mean low water over the shoalest part of the channel under improvement was 7 feet.

The amount expended on this improvement to June 30, 1903, was \$62,338.91, of which \$2,437.39 was for maintenance.

The commerce reported for last calendar year is 172,803 tons, valued at \$3,687,981. That reported in 1896 was 17,193 tons, valued at \$647,893.

(g) *Warwick River, Maryland.*—This river, formerly named Secretary Creek, is in Dorchester County, eastern shore of Maryland, and flows into the Choptank River, one of the larger tributaries of Chesapeake Bay. It is a small tidal basin 2 miles long, with no fresh-water influx at the head, and was originally only 4 feet deep. The average rise of the tide is 2 feet.

Before the adoption of the present project, about \$12,000 had been expended in the improvement of this river, \$6,000 by the General Government and the remaining amount by private parties. The present project for improvement, which was proposed in a report on a survey in 1891, provides for a channel 100 feet wide and 10 feet deep at mean low water from the 10-foot depth in Choptank River to Secretary Landing, at the head of the river, including a turning basin at the latter point, at an estimated cost of \$18,600.

In 1892-93, beginning in the Choptank River, 4,400 feet of the channel and a portion of the turning basin were dredged to a depth of 10 feet at mean low water; and in 1896 the turning basin was dredged and shoals which had formed at the Mud flats and Harrissons Gut were removed. In 1898 the channel was dredged from a point 400 feet below Cedar Point up the river a distance of 1,900 feet to Devils Wind Gap, the depth made being 10 feet at mean low water and the width 100 feet, and a cut 25 feet wide and 400 feet long was dredged across Spences bar just below the entrance to the turning basin; and in 1900 the channel was dredged for a length of 1,360 feet from opposite the upper side of Devils Wind Gap upstream and the turning basin redredged. This left about 450 feet of the channel at Devils Wind Gap to be dredged to the project dimensions, and the restoration of the channel at other points where it had shoaled, to complete the project.

Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for dredging certain harbors and rivers on the easterly shore of Chesapeake Bay, the sum of \$4,000 was allotted for continuing the improvement of this river.

Under a contract made for dredging at this and other improvements on the easterly shore of Chesapeake Bay, work was prosecuted at this place in July, 1903. No work was done during the past fiscal year.

The amount expended on this improvement to June 30, 1903, is \$12,004.50.

The maximum draft that could be carried June 30, 1903, at mean low water, over the shoalest part of the channel under improvement was 8 feet.

The commerce reported for the past calendar year is 58,070 tons, valued at \$1,205,542. That reported for the year 1896 was 3,617 tons, valued at \$140,937.

(h) *Pocomoke River, Maryland.*—This river has been under improvement by the General Government since 1878. In 1879 and 1880 \$12,500 was expended on work below Snowhill, chiefly in the rectification of the channel by the turning off of sharp angles and giving increased width, the depth of excavation being to 7 feet at mean low water; and in 1888, with an appropriation of \$8,000, a cut-off was made through the low neck of land forming four abrupt bends just below Snowhill. At the close of these operations there was a channel not less than 80 feet wide and 7 feet deep between Snowhill and Shad Landing, a distance of about $4\frac{1}{2}$ miles.

The present project, adopted October 1, 1896, is based upon a survey made in 1894-95, and is for dredging the channel between Snowhill and Shad Landing to a depth of 9 feet at mean low water and a width of from 100 to 130 feet, at an estimated cost of \$14,000. The mean range of tide is $2\frac{1}{2}$ feet.

In 1897 and 1901 the channel was dredged at nine places between Nassawango Creek and the county wharf at Snowhill, resulting in a 9-foot channel at mean low water, the width varying between 80 and 130 feet. This left the channel from the lower cut-off to Snowhill, a distance of about 1 mile, and the dredging of the channels where it had shoaled, to complete the project.

Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for dredging certain harbors and rivers on the easterly shore of Chesapeake Bay, the sum of \$4,800 was allotted for continuing the improvement of this river.

Under a contract made for dredging at this and other improvements on the easterly shore of Chesapeake Bay, it is proposed to use this allotment in widening the channel previously dredged and where shoals have formed to obtain a depth of 9 feet at mean low water. This work is to be completed by December 31, 1903.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel under improvement was 4 feet.

To the end of the fiscal year \$28,504.25 had been expended for the improvement of this river, of which \$8,004.25 was on the present project.

The commerce for the past calendar year is reported at 47,733 tons, valued at \$1,409,504; that reported in 1898 was 45,742 tons, valued at \$325,924.

(i) *Wicomico River, Maryland.*—The portion of the river at and just below Salisbury, which is the head of navigation, has been under improvement by the United States since 1872. At that time the navigable channel, with a minimum depth of 8 feet at low water, extended to a point within 2 miles of Salisbury. The extreme upper portion, as far as the milldam in the heart of the town, was quite shoal, and had an average depth of only 18 inches at low tide. Between 1872

and 1885 a channel 75 to nearly 100 feet wide and 7 feet deep at low water was dredged from deep water below to the drawbridge in the town at a cost to the Government of about \$50,000.

The present project, based upon a survey of the river made in 1889, provides for a channel 9 feet deep at mean low water from that depth below to the drawbridge at Salisbury, the width to be from 100 to 150 feet, at an estimated cost of \$23,200.

At the time this project was adopted there existed a 7-foot low-water channel from 75 to 100 feet wide to Salisbury. In the winter of 1891-92 the channel was deepened to 9 feet below mean low water for a width of 30 feet between the bridge at Salisbury and a point about 100 feet above Goose Island wharf, a distance of 9,250 feet. In the winter of 1893-94 the channel was dredged to the project dimensions from the bridge at Salisbury to a point 3,930 feet below, and in 1895 the channel was dredged for a further distance of 1,800 feet. In 1898 the channel was dredged to the project dimensions from Williams Point to Goose Island wharf, a distance of 2,750 feet, and above Williams Point, where the channel previously dredged had shoaled and narrowed considerably, six cuts, 25 feet wide and aggregating 2,925 feet in length, were dredged to the approved depth.

Of the \$74,000 appropriated by the river and harbor act of June 13, 1902, for certain harbors and rivers on the easterly shore of Chesapeake Bay, \$6,798 was allotted for continuing the improvement of this river, and a contract has been made for dredging this and the other improvements covered by the appropriation, the entire work provided for by it to be completed by December 31, 1903.

No work has been done on the river during the past fiscal year.

The amount expended to June 30, 1903, is \$73,247.33, of which \$50,000 was on previous projects.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel under improvement was 6 feet.

The commerce reported for the past calendar year is 168,226 tons, valued at \$3,929,555. That reported in 1891, before the improvement on present project was begun, was 36,262 tons, valued at \$657,745.

(j) *Tyaskin Creek*.—This stream is also known as Wetipquin Creek or River. It is a small tributary of the Nanticoke River, having a length of about 5 miles. No work has ever been done on this creek. The controlling depth in the creek is 8 feet, but on the bar at the mouth it is reported to be but 3½ feet at mean low water, with an average rise and fall of the tide of 3 feet. The present commerce is not large, but the prospective commerce is reported as justifying an improvement of the stream. An examination of the stream was made in 1888, and an examination and survey were also made in 1899. The report upon the latter proposes a channel 9 feet deep at mean low water with a width of 120 feet, at an estimated cost of \$13,200. The river and harbor act of June 13, 1902, appropriated \$74,000 for improving certain harbors and rivers on the easterly shore of Chesapeake Bay, Maryland, including this creek, and provided that its improvement should be made in accordance with report submitted in House Document No. 109, Fifty-sixth Congress, first session. This will be found printed in the Annual Report of the Chief of Engineers for 1900, pp. 1681-1684. The report of 1899 is that above referred to. Of the amount appropriated \$8,000 was allotted for beginning the improvement, and contract for

dredging works named in appropriation has been made and provides for the completion of the work covered by it by December 31, 1903. No work has been done on the improvement during the past fiscal year.

The amount expended to June 30, 1903, on this improvement is \$9.20, which was for contingent expenses.

The maximum draft that could be carried June 30, 1903, at mean low water, over the shoalest part of the channel was 4 feet.

The commerce reported for the past calendar year is 713 tons, valued at \$30,459.

July 1, 1902, balance unexpended	\$74,321.22
June 30, 1903, amount expended during fiscal year	9,957.42
July 1, 1903, balance unexpended	64,363.80
July 1, 1903, outstanding liabilities	3,605.53
July 1, 1903, balance available	60,758.27
July 1, 1903, amount covered by uncompleted contracts	53,293.62

(Amount (estimated) required for completion of existing project	a 68,705.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	a 40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 15.)

16. *La Trappe River, Maryland.*—This stream, formerly known as Dividing Creek, has a length of about 3 miles and is a tributary of the Choptank River. The head of navigation is at Trappe Landing. The controlling depth prior to 1893 was 4 feet, with a mean range of tide of 18 inches, but was afterwards increased to 8 feet by dredging, under private subscription. The original project is the existing one, adopted August 5, 1892, and is for a channel 150 feet wide and 11 feet deep at mean low water across the bar at the mouth, and for a width of 75 feet and a depth of 8 feet inside the bar as far as Trappe Landing, with a turning basin at the latter point, at an estimated cost of \$7,250, subsequently increased to \$9,750. The amount expended to June 30, 1903, is \$7,213.87, and has resulted in completing the project except for a length of 1,200 feet over the bar, where the width is but 100 feet.

No work has been done during the past fiscal year.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel was 7 feet.

The commerce of the river for the calendar year 1902 is reported to be 11,241 tons, valued at \$294,530.

July 1, 1902, balance unexpended	\$36.13
July 1, 1903, balance unexpended	36.13

(Amount (estimated) required for completion of existing project	2,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 16.)

a Wicomico River not included in this estimate.

17. *Nanticoke River, Delaware and Maryland.*—This river is a tidal stream, its headwaters consisting of numerous branches rising mainly in the northern section of Sussex County, Del. The river flows in a south-southwesterly direction into Tangier Sound, Chesapeake Bay, and the interests for the improvement of the river center at Seaford, 36 miles from the mouth.

The river and harbor act of August 18, 1894, appropriated \$5,000 for improving Broad Creek River, Delaware, a branch of Nanticoke River, and provided that as much of it as might be necessary should be used for the removal of the bar extending from the railroad bridge at Seaford toward the mouth of Nanticoke River. With this appropriation the channel was dredged where necessary to a width of 100 feet and a depth of 9 feet at mean low water, from the south side of the railroad bridge at Seaford to a point 8,000 feet below. A previous appropriation for the Nanticoke River in 1886 was, in accordance with the terms of the law, applied to Broad Creek River up to Laurel.

The project for the improvement of the Nanticoke River is based upon a survey made in 1895, and is for a channel 9 feet deep at mean low water and 100 feet wide, the width to be increased to about 150 feet at sharp turns of the channel, the improvements to be extended to within 100 feet of the county bridge, where the proposed channel is to widen out fan shape, at an estimated cost of \$13,000.

In 1898 the channel above and below the railroad bridge at Seaford was dredged to the project dimensions, except in a bend about 2,900 feet below, and the latter was dredged in 1900. No work has been done since, and the balance on hand is held for maintenance.

The amount expended to June 30, 1903, was \$10,263.50, of which \$5,000 was on a previous project, no part of which was applied to maintenance. An examination of the channel was made in July, 1902. The expenditure was on that account. The range of tide is about 3.4 feet at Seaford, the head of navigation.

The maximum draft that could be carried June 30, 1903, at mean low water, over the shoalest part of the channel, was 7 feet.

The commerce of the river for the past fiscal year is reported at 96,214 tons, valued at \$1,131,904. In 1899 it was reported at 18,121 tons, valued at \$659,031.

July 1, 1902, balance unexpended	\$786.50
June 30, 1903, amount expended during fiscal year	50.00
July 1, 1903, balance unexpended	736.50
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

2, 000. 00

(See Appendix J 17.)

18. *Broad Creek River, Delaware.*—This is tributary of the Nanticoke River, and in 1881 the controlling depth was 1½ feet, with a mean range of tide of 3 feet. In 1889 a channel 6 feet deep at mean low water and 50 feet wide had been dredged from Bethel to Laurel, the head of navigation, at a cost of \$35,000. The existing project, adopted August 5, 1892, is for a channel 70 feet wide and 8 feet deep at mean low water, between Bethel and Laurel, at an estimated cost of \$15,000.

The projected channel has been dredged, except for a short distance at the upper end, where it is reduced to 60 feet in width to secure the stability of some wharves. The amount expended to June 30, 1903, on the existing project is \$14,675.20. The expenditure during the year was for an examination.

The maximum draft that could be carried June 30, 1903, at mean low water, over the shoalest part of the channel, is reported to be 6½ feet.

It has been impracticable to obtain complete commercial statistics.

July 1, 1902, balance unexpended	\$374. 80
June 30, 1903, amount expended during fiscal year	50. 00

July 1, 1903, balance unexpended	324. 80
--	---------

(See Appendix J 18.)

19. *Manokin River, Maryland.*—Before improvements were commenced in 1891 the depth of water at the mouth of the river at the so-called "Mud flats" was between 1 and 2 feet at low tide. These flats are about 2½ miles wide, and make navigation impossible except at high water, thereby rendering the upper part of the river, which has a very fair depth and width, almost useless for extensive shipping purposes. The average rise of the tide at the flats is 2.6 feet.

This project was adopted in 1890, and is based upon a survey made in August and September, 1889. It provides for a channel 6 feet deep at mean low water and 100 feet wide from Locust Point to Sharps Point, a distance of about 2½ miles, and embracing the section called the "Mud flats," at an estimated cost of \$30,000.

In 1891 a cut 30 feet wide and 5 feet deep at mean low water was made for a distance of 13,515 feet between Locust Point and Sharps Point, and in the upper river above Sharps Point several abrupt points were removed and navigation upon the whole river thereby greatly improved. In 1892-93 the cut previously made at the mouth was partly redredged and the whole widened to 60 feet. The depth made was 6 feet at mean low water. In 1895 the channel was redredged to a depth of 6 feet at mean low water, and widened to 80 feet for a length of 3,520 feet.

In 1900 the widening of the 60-foot cut at the mouth to 80 feet was continued for a length of 1,270 feet, and the channel previously made was redredged for a distance of 2,175 feet; and in the upper river the channel was dredged to a depth of 6 feet at mean low water from that depth opposite Dashiells Creek upstream toward the county wharf for a distance of 4,940 feet, the width made being 50 feet. This latter work was done under the terms of the act making the appropriation. At the close of these operations there was a channel 6 feet deep from Sharps Point to about a mile above Dashiells Creek and a slightly less depth to the steamboat wharf above, and at the mouth soundings taken over the area formerly dredged showed a range of depth from 4.5 to 7.3 feet. No work has been done during the past year. The expenditure was for an examination.

The amount expended on the improvement to June 30, 1903, is \$22,434.97, and \$2,000 additional was expended on the upper river, which is not included in the existing project.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the channel at the mouth was 4½ feet.

It was impracticable to obtain complete commercial statistics, but it

is reported that the commerce has increased between 5 and 10 per cent over that reported for 1896, which was 32,076 tons, valued at \$522,990.

July 1, 1902, balance unexpended	\$115.03
June 30, 1903, amount expended during fiscal year	50.00
July 1, 1903, balance unexpended	65.03
(Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix J 19.)

20. *Removing sunken vessels or craft obstructing or endangering navigation.*—During the past fiscal year wrecks were removed as follows: Canal boat *Ida May*, from Rancocas River, New Jersey; schooner *Elsie M. Harris*, from off Green Run Inlet life-saving station, coast of Maryland; schooner *Van Sciver* and sloop *Nettie*, from Little Creek, Delaware; scow in Cooper Creek, New Jersey; barge *Henry C.*, in Cohansey Creek, New Jersey; and schooner *R. & T. Hargraves*, from off Tucker Beach light-house, New Jersey.

In addition to the foregoing, examinations have been made as follows: Schooners *Addie Thatcher* and *Little Myro*, lying sunk in Deal Island Harbor, Maryland; sloop *Three Brothers*, sunk near Baxter's wharf, Schuylkill River, Pennsylvania; English iron steamer *Amy Dora*, off Wachapreague Inlet life-saving station, coast of Virginia; English steamer *Sutton*, at Fenwicks Island shoal, Maryland; English steamer *Uriarte No. 4*, off Popes Island, Virginia; English steamer *Oakdene*, off Chincoteague light-house, Virginia; and schooner *Jas. K. Burnite*, in Leipsic River, Delaware.

The amount expended for the examination and removal of wrecks during the fiscal year was \$3,689.60.

(See Appendix J 20.)

IMPROVEMENT OF PATAPSCO RIVER AND BALTIMORE HARBOR, MARYLAND.

This district was in the charge of Col. Peter C. Hains, Corps of Engineers (now brigadier-general United States Army), to March 31, 1903; in the temporary charge of Lieut. Col. Chas. J. Allen, Corps of Engineers, from March 31 to June 10, 1903, and in the charge of Col. W. A. Jones, Corps of Engineers, since June 10, 1903.

1. *Patapsco River and channel to Baltimore, Md.*—In October, 1853, when dredging was begun by the United States on a project dated April 15, 1853, for a channel 22 feet deep at mean low water, and 150 feet wide, at an estimated cost of \$390,000, the controlling depth was 17 feet. The mean range of the tide is a little over one foot. There have been three succeeding projects, each one with a view to increasing the dimensions of the original channel, two of them making some modifications in the direction of it. The three projects prior to the existing one were carried out, until in 1892 there was a channel from the entrance to Baltimore Harbor to a point in Chesapeake Bay off the mouth of the Magothy River, about 19 miles long, 27 feet deep at mean low water, 600 feet wide at bottom

in the straight reaches, and over 1,200 in the angles, made at a cost of \$3,316,030. The existing project approved July 10, 1896, is to increase the channel depth to 30 feet at mean low water, retaining the bottom width and making side slopes of 3 feet base to 1 vertical, at an estimated cost of \$2,500,000, and \$50,000 per annum for maintenance. The existing project was completed May 22, 1903, at a cost of \$1,371,709.28. The saving on the estimate was due to dumping the dredged material in Chesapeake Bay instead of putting it ashore as was anticipated in the estimate of cost. Arrangements are in progress for entering into a contract for maintenance of the channel to June 30, 1904.

The draft that can now be carried to Baltimore, to which point the Patapsco River is navigable in fact, is 30 feet at mean low water, but this is not adequate for the commerce of the port. The depth, at least, should be increased to accommodate at full draft the vessels using the port. With this in view Congress, by concurrent resolution, called for an estimate of the cost of increasing the depth of the channel to 35 feet. That estimate is printed in Senate Document No. 118, Fifty-sixth Congress, second session; a revised estimate is printed in House Document No. 186, Fifty-seventh Congress, second session, and is also herewith as Appendix K 4. If no appropriations are made at the next session of Congress for this 35-foot project, \$50,000 will be required to maintain 30 feet depth in the channel to June 30, 1905.

The tonnage movement of the port has been as follows:

Fiscal year ending June 30—	Tons.	Fiscal year ending June 30—	Tons.
1889.....	3, 243, 017	1897.....	6, 868, 120
1890.....	4, 237, 361	1898.....	7, 339, 405
1891.....	4, 495, 469	1899.....	6, 843, 620
1892.....	5, 224, 042	1900.....	7, 941, 580
1893.....	4, 607, 176	1901.....	8, 055, 017
1894.....	4, 752, 946	1902.....	7, 529, 870
1895.....	4, 794, 964	1903.....	7, 736, 447
1896.....	5, 363, 894		

The statistics of the port for the past fiscal year are illustrated briefly by the following table:

Dutiable imports have increased.....	\$7, 841, 152. 00
Free imports have decreased.....	\$2, 979, 853. 00
Domestic exports have increased.....	\$1, 167, 922. 00
Tonnage (foreign) has decreased..... tons..	13, 063
Duties collected have increased.....	\$1, 842, 137. 77
Duties on merchandise in bond have decreased.....	\$33, 396. 03
Duties on merchandise in bond with and without appraisement have decreased.....	\$224, 575. 67

References.

Subject.	When made.	Document.	Annual Report.
History.....			1874, p. 18 (Part II).
Do.....			1900, p. 231.
Survey.....	1894	House Ex. 57, 53d Cong., 3d sess.....	1895, p. 1201.
Do.....	1896	House 50, 54th Cong., 2d sess.....	1897, p. 1308.
Do.....	1901	Senate 118, 56th Cong., 2d sess.....	1901, p. 1395.
Do.....	1902	House 186, 57th Cong., 2d sess.....	1903, p. 1032.

July 1, 1902, balance unexpended\$271, 893. 24
 June 30, 1903, amount expended during fiscal year..... 218, 602. 52

July 1, 1903, balance unexpended 53, 290. 72
 July 1, 1903, outstanding liabilities 42. 60

July 1, 1903, balance available 53, 248. 12

{ Amount that can be profitably expended in fiscal year ending June 30, 1905,
 for maintenance of improvement, in addition to the balance available
 July 1, 1903..... 50, 000. 00
 Submitted in compliance with requirements of sundry civil act of June 4,
 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix K 1.)

2. *Channel to Curtis Bay, in Patapsco River, Baltimore Harbor, Maryland.*—With a mean range of tide of a little over 1 foot, there was a controlling depth of 20 feet at mean low water in 1893, when the first improvement was undertaken by the United States. The original project was dated July 15, 1892, and was for a channel 27 feet deep at mean low water and a bottom width of 150 feet, at an estimated cost of \$85,000. Forty thousand dollars of the estimate was appropriated, and with this total expenditure the channel was first made 25 feet deep for the project width and then dredged to 27 feet depth for a width of 70 feet in the axis of the 150-foot channel. That project never was completed. It was superseded by a project in the river and harbor act approved June 13, 1902, for deepening the channel to 30 feet and widening it to 250 feet, and authority granted to make continuing contracts to complete the work. The estimated cost is \$196,000.

A continuing contract was made, and about one-third of the dredging is done. It is expected that the channel will be completed December 31, 1903. The amount expended on the existing project to June 30, 1903, is \$60,735.77. Curtis Bay is the mouth of Curtis Creek, which is navigable in fact 5½ miles above the head of the channel contemplated by the existing project, but a maximum draft of 30 feet at mean low water can be carried June 30, 1903, over the shoalest part of the locality under improvement.

This bay is in the collection district of Baltimore, and the statistics are attached to the report for that harbor.

References.

Subject.	When made.	Document.	Annual Report.
Survey	1890	House Ex. 102, 51st Cong., 2d sess	1891, p. 1243.
Do.....	1901	Senate 118, 56th Cong., 2d sess.....	1901, p. 1394.
History.....			1901, p. 265.

July 1, 1902, balance unexpended \$50, 000. 00
 Amount appropriated by sundry civil act approved March 3, 1903 146, 000. 00

June 30, 1903, amount expended during fiscal year 196, 000. 00
 60, 735. 77

July 1, 1903, balance unexpended 135, 264. 23
 July 1, 1903, outstanding liabilities 349. 21

July 1, 1903, balance available 134, 915. 02

July 1, 1903, amount covered by uncompleted contracts..... 118, 365. 84

(See Appendix K 2.)

3. *Harbor of southwest Baltimore (Spring Garden), Md.*—No work was done by the United States before the existing contract, but the city of Baltimore dredged a channel from the main ship channel to the foot of Eutaw street, which has a controlling depth of 15 feet at mean low water. The average rise of the tide is a little over 1 foot. In response to a resolution of the House of Representatives an estimate was furnished, March 7, 1896, of the cost of deepening the channel to a depth of 27 feet. It is for a channel 100 feet wide on the bottom, with side slopes of 1 on 3, from the main ship channel near Fort McHenry to the foot of Eutaw street, with a turning basin 400 feet by 400 feet near the upper end, at an estimated cost of \$314,000. Five thousand dollars was appropriated June 3, 1896, but it was deemed inexpedient to start the work with that small sum. June 13, 1902, \$88,000 was appropriated and authority granted to enter into contracts for the completion of the work. A continuing contract was made for the completion of the project, and dredging is in progress under it. The sum of \$45,312.97 has been expended to June 30, 1903. The maximum draft that can be carried June 30, 1903, at mean low water over the shoalest part of the locality under improvement to Light Street Bridge is 27 feet, and thence to the foot of Eutaw street, which is the head of navigation and the extent of the project, 15 feet.

The commercial statistics of the port of Baltimore include this harbor.

Reference.

Subject.	When made.	Document.	Annual Report.
Survey	1896	House 304, 54th Cong., 1st sess.....	1896, p. 1006.
July 1, 1902, balance unexpended			\$93, 000. 00
Amount appropriated by sundry civil act approved March 3, 1903			221, 000. 00
			314, 000. 00
June 30, 1903, amount expended during fiscal year			45, 312. 97
July 1, 1903, balance unexpended			268, 687. 03
July 1, 1903, outstanding liabilities			174. 20
July 1, 1903, balance available			268, 512. 83
July 1, 1903, amount covered by uncompleted contracts			244, 957. 73

(See Appendix K 3.)

IMPROVEMENT OF POTOMAC RIVER AND ITS TRIBUTARIES; OF JAMES RIVER AND OF HARBOR AT MILFORD HAVEN, VIRGINIA, AND OF CERTAIN RIVERS IN MARYLAND AND VIRGINIA ON THE WESTERN AND EASTERN SHORES OF CHESAPEAKE BAY; PROTECTION OF JAMESTOWN ISLAND, VIRGINIA.

This district was in the charge of Lieut. Col. Chas. J. Allen, Corps of Engineers.

1. *Potomac River at Washington, D. C.*—The Potomac River is navigable to the foot of Little Falls, 3 miles above Georgetown, but the Aqueduct Bridge, which crosses the river at Georgetown, has no draw and limits the navigation of large steamers and masted vessels.

Between June 11, 1870, and March 3, 1881, the sum of \$290,000 was appropriated by Congress for the improvement of the harbors

of Washington and Georgetown. The project under which this sum was expended is not definitely stated, although it is understood that it provided for dredging channels 16 feet deep and 200 feet wide through the Georgetown and Washington channels and for the removal of the most dangerous rocks obstructing navigation in the harbor of Georgetown to a depth of 20 feet.

A survey of the Potomac River in the vicinity of Washington was made in 1881, the report of which is printed in Senate Executive Document No. 126, Forty-seventh Congress, first session, and also in the Annual Report of the Chief of Engineers for 1882, pages 980-987.

The Virginia channel was obstructed by two bars. The upper bar extended from Long Bridge to about one-half mile below Easbys Point. The ruling depth on this bar was 8 feet in 1857, while in 1871 it was 10 feet, in 1873 it was 13½ feet, and in 1881, 15 feet. The improvement was due to frequent dredging, but after every freshet the dredged channel was nearly obliterated. The lower bar, 3,200 feet long, was near Giesboro Point, and in 1874 had a ruling depth of 14 feet, which was increased by dredging in 1874-75 to 16 feet, which was the ruling depth in 1881. Below Long Bridge the Washington channel was shoal, its ruling depth in 1878 being 10 feet. The depth was increased by dredging so that in 1881 a depth of 16 feet could be found along the greater part of the wharf front.

The flats extended from the Washington shore to the edge of the Virginia channel. Large quantities of sewage were carried at high tide over these flats and distributed by the flow among the rank growth of sedges and aquatic plants with which the flats were covered. As the tide fell this mass of sewage was left exposed to the rays of the sun. These conditions combined to generate effluvia, which rendered the adjacent portions of the city almost uninhabitable, and at the same time caused malarial and other diseases.

The existing project for the improvement was adopted by the act of Congress of August 2, 1882, and has for its object the improvement of the navigation of the river by widening and deepening its channels, the reclamation of the flats by depositing on them the material dredged from the channels, the freeing of the Washington channel of sewage, and the establishment of harbor lines. To effect these the project provided "that the channel depths * * * should be sufficient to accommodate the largest draft vessels that can be brought up to Arsenal Point" (the projected depth was not stated in feet, but by the above-imposed condition was, at that time, limited to 20 feet at low tide, whereas the ruling depth in the Potomac River below Washington has been increased to 24 feet at low tide, by dredging completed during the past fiscal year); that the flats be reclaimed to a height of 3 feet above the flood plane of 1877 (which, although the highest recorded freshet at that time, was exceeded by about 3 feet by the flood of 1889) for a tidal reservoir to be provided with automatic inlet and outlet gates, and for an ample system of drainage for the reclaimed area. A training dike on the Virginia shore, extending downstream from Analostan Island, was added to the project in 1890. The project also provided for the rebuilding of Long bridge, and for the interception of all sewage discharged into the Washington channel, but neither of these works was included in the estimated cost of the improvement, which was \$2,716,365. The estimate as revised in 1897 is \$2,953,020.

The amount expended on the work of the existing project up to the

close of the fiscal year ending June 30, 1903, was \$2,353,712.06, of which about \$50,000 was applied to maintenance.

The expenditure resulted in the dredging of a channel 20 feet deep and 550 feet wide through the bar above Long Bridge and in restoring the standard 20-foot navigation by dredging shoals due to freshets; in increasing the width of the natural channel just below Long Bridge by 50 to 500 feet and in deepening it to 20 feet; in dredging a channel 350 feet wide and 20 feet deep through the bar in the Virginia channel near Giesboro Point; in dredging the Washington channel to a width of 400 feet and a depth of 20 feet for a navigation channel, and in dredging between this navigation channel and the wall of the adjacent reclaimed area to a depth of 12 feet; in dredging at the junction of the Washington and Virginia channels; in dredging the tidal reservoir (111 acres) to a depth of about 8 feet; in the construction of the reservoir outlet, and in the construction of 35,289 linear feet of sea wall, of which 4,190 linear feet has been taken down and relaid, and 5,965 linear feet of training dike.

The area of land reclaimed by these operations is 621.12 acres (or, including reservoirs, 739.42 acres), which, by act of March 3, 1897, was declared to be a public park, under the name of Potomac Park.

The maximum draft that could be carried through the Washington channel on June 30, 1903, at mean low tide, was 19 feet; for the Virginia channel it was 18 feet. The mean range of tides is about 3 feet.

The benefits to navigation from the improvements have been marked. Vessels can come to Washington loaded more heavily than was formerly the case. The value of the commerce to be benefited may be judged by examination the following table, showing the commerce of the port of Washington, in tons, from 1887 to 1902, inclusive:

	Tons.		Tons.
1887	618, 972	1895	693, 450
1888	581, 575	1896	723, 657
1889	488, 680	1897	593, 684
1890	519, 696	1898	645, 239
1891	551, 219	1899	715, 549
1892	766, 954	1900	661, 420
1893	653, 433	1901	708, 551
1894	644, 588	1902	672, 912

The additional work proposed is necessary for extension of benefits to navigation interests and for the maintenance of the improvement in a serviceable condition.

Maps of the locality may be found in each Annual Report of the Chief of Engineers since 1877, with the exception of those for 1879, 1882, and 1893.

July 1, 1902, balance unexpended	\$87, 588. 24
June 30, 1903, amount expended during fiscal year	7, 300. 30
July 1, 1903, balance unexpended	80, 287. 94
July 1, 1903, outstanding liabilities	139. 00
July 1, 1903, balance available	80, 148. 94
{ Amount (estimated) required for completion of existing project	519, 020. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	200, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L.)

2. *Potomac River below Washington, D. C.*—The Potomac River below Washington, D. C., is generally a wide and deep body of water, having the characteristics of a tidal estuary rather than of a fluvial stream.

In 1891 a survey of the obstructions to 24-foot navigation was made and a report rendered which is printed as House Executive Document No. 33, Fifty-second Congress, first session, and in the Annual Report of the Chief of Engineers for 1892, page 1069.

Prior to the improvement of the river the following obstructions to 24-foot navigation were encountered in order ascending the river, viz: Kettle Bottom shoals, with a ruling depth of 23 feet at low tide; Maryland Point shoal, with 22 feet; Smiths Point lower shoal, with 23 feet; Smiths Point upper shoal, with 21 feet, and Mattawoman shoal, with but 19.5 feet. Several of these shoals were long, forming serious obstructions to navigation by deep-draft vessels.

The present, which is also the original, project for this improvement, was adopted by act of Congress of March 3, 1899. This project provides for the improvement of the waterway by dredging channels 24 feet deep and 200 feet wide through all obstructions to 24-foot navigation below Washington, D. C., at an estimated cost of \$176,000.

The amount expended to June 30, 1903, was \$158,121.11, of which about \$22,000 was applied to maintenance. As a result of this expenditure, channels 24 feet deep and at least 200 feet wide—those at Kettle Bottom and Mattawoman shoals being made somewhat wider for maintenance—have been dredged through all of the above shoals. The channels, although narrow, have been buoyed and are of great benefit to deep-draft vessels traversing the river.

The maximum draft that could be carried over the shoals in the Potomac River below Washington, D. C., on June 30, 1903, at mean low tide was 24 feet. The mean range of tides is about 1.6 feet.

The total tonnage annually passing through these channels is estimated at about 1,000,000 tons. In this connection reference is made to the commercial statistics in the report upon the Potomac River at Washington, D. C.

The work provided for under the present project has been completed and no further appropriation is required therefor. A channel only 200 feet wide is, however, regarded as rather contracted for a river of the width and importance of the Potomac, and especially in view of the location of the Washington Navy-Yard upon its shores.

It is hoped that an increase in width of these channels to 400 feet may soon be authorized by Congress.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1890, 1900, and 1902.

July 1, 1902, balance unexpended	\$90,793. 73
July 30, 1903, amount expended during fiscal year.....	72,914. 84

July 1, 1903, balance unexpended	17,878. 89
--	------------

(See Appendix L 2.)

3. *Anacostia River, District of Columbia.*—Congress by act approved June 13, 1902, appropriated the sum of \$150,000 for improving Anacostia River, with a view to the interests of commerce and navigation, in accordance with such portions of the report submitted in House Document No. 87, Fifty-fifth Congress, third session (reprinted at page 1443 of Annual Report of the Chief of Engineers for 1899),

as relates to section 1 of said river, being the portion below the navy-yard bridge.

The part of the project considered in the report referred to (H. Doc. No. 87, 55th Cong., 3d sess.) relating to the main channel for commerce and navigation, provided for a channel 20 feet deep at mean low tide, and 400 feet wide from the mouth of the river to the navy-yard, including sufficient turning room in front of the yard. The estimated cost of this work is \$1,218,525.

The last work done upon the Anacostia by the Engineer Department for improvement of the navigation of the stream was under an allotment of \$20,000, included in the item in the act of September 19, 1890, for improving the Potomac River at Washington. Under this allotment channels 20 feet deep and about 200 feet wide were dredged through shoals near the foot of South Capitol street and off Greenleaf or Arsenal Point. This dredging was completed in May, 1892, at a cost of \$18,536.94.

The mean range of tides is 3 feet. The maximum draft that could be carried on June 30, 1903, over the shoalest part of the locality under improvement was 19 feet.

Before work of improvement was undertaken in 1892 the ruling depth from the mouth to the navy-yard bridge was about 18 feet, with tortuous channels.

The present project for expenditure of the appropriation of June 13, 1902, consists in dredging a channel 20 feet deep and 300 to about 400 feet in width from the river mouth to the upper limits of the navy-yard, some slight increase in depth to be given immediately in front of the yard if practicable and if needed. The dredging to include easing the bends so far as can be done.

A contract for the dredging was made January 3, 1903, and preparatory work commenced in February.

The commerce of the Anacostia now amounts to about 250,000 tons annually, and it is anticipated that the tonnage will greatly increase with improvement of the channel.

The sum asked for the year ending June 30, 1905, is to be applied to continuance of the work on section 1 in widening channels.

The amount expended on the work of the existing project to June 30, 1903, was \$18,119.93, none of which was applied to maintenance.

July 1, 1902, balance unexpended	\$151,463.06
June 30, 1903, amount expended during fiscal year	18,119.93
July 1, 1903, balance unexpended	133,343.13
July 1, 1903, outstanding liabilities	279.00
July 1, 1903, balance available	133,064.13
July 1, 1903, amount covered by uncompleted contracts	122,703.00

Amount (estimated) required for completion of existing project	1,067,061.94
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	200,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 3.)

4. *Breton Bay and Patuxent River, Maryland.*—(a) *Breton Bay.*—Breton Bay is a tidal estuary of Potomac River, which it enters from the left bank at a point about 82 miles below Washington, D. C. The

bay is about $6\frac{1}{2}$ miles long and well landlocked. Fifteen feet of water can be carried up the bay for a distance of 4 miles and 10 feet to Leonardtown, situated at the head of navigation, 6 miles above the mouth of the bay.

A survey of Breton Bay was made in 1874 (see Annual Report of the Chief of Engineers for 1875, pp. 108-110), which showed that at that time navigation was obstructed by a shoal at the head of the bay extending downstream from the Leonardtown wharf for about 1 mile, the least depth on the shoal being 5 feet at low tide.

The original project for improvement, adopted in 1878, provided for dredging a channel 150 feet wide and 9 feet deep from the 9-foot contour in Breton Bay to the Leonardtown wharf, with a turning basin for steamboats at the wharf 400 feet wide and 600 feet long, at an estimated cost of \$30,000. In 1886 the project was amended so as to provide for a channel 200 feet wide and 10 feet deep, the turning basin to be 800 feet long and 400 feet wide. The estimated cost of the amended project was \$49,000. In 1890 the original project was resumed, a width of 150 feet and depth of 9 feet being deemed sufficient to furnish all the facilities needed by navigation at that time.

From June 18, 1878, to September 19, 1890, nine appropriations, aggregating \$37,500, were made. This sum was applied to dredging 214,229 cubic yards of material. The work called for by this project was completed August 25, 1891. The channel was then 9 feet deep at low tide from the original 9-foot contour in Breton Bay to the Leonardtown wharf. The width of the channel was 150 feet, and at the turn off Buzzards Point it was made 320 feet to facilitate the turning of steamers. The basin at Leonardtown was 9 feet deep, 370 feet wide, and 600 feet long.

A new survey of Breton Bay was made in 1899, the report of which was printed as House Executive Document No. 209, Fifty-sixth Congress, first session, and also in the Annual Report of the Chief of Engineers for 1900, pages 1743-1746. The survey showed that the channel had narrowed and the turning basin narrowed and shoaled since the completion of the work in 1891.

The present project for this improvement was adopted by act of Congress of June 13, 1902, and contemplates the dredging of a channel and turning basin 10 feet deep; the channel to have a minimum width of 200 feet, and the turning basin to be 400 feet wide and 600 feet long. The estimated cost of the project is \$36,480.

The amount expended under the present project to June 30, 1903, was \$5,996.03, none of which was applied to maintenance. As a result of this expenditure a channel at least 100 feet wide, 10 feet deep, and 3,800 feet long has been dredged through the shoalest portion of the bar, with the turning basin of the same depth, 200 feet wide and 400 feet long. The maximum draft that could be carried on June 30, 1903, at mean low water, over the shoalest part of the locality under improvement was 10 feet, but the channel affording this depth was narrow and crooked. The mean range of tides is about 1.7 feet.

It is difficult to obtain satisfactory commercial statistics for this locality, but it is estimated that the value of receipts and shipments is about \$225,000 per annum, and that the number of passengers is about 2,000 a year. The work already done has been of great benefit to navigation.

The additional work proposed is for the purpose of extension of these benefits.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives the Board of Engineers for Rivers and Harbors has considered the project for this work and has submitted a special report thereon, which will be found by reference to Appendix L 4, herewith.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887 and 1889.

(b) *Patuxent River*.—Patuxent River is a tributary of Chesapeake Bay and is navigable for large river steamers to Bristol Landing, Maryland, a distance of about 46 miles. The lower part of the river has the character of a tidal estuary with a width of from 1 to 2 miles. Eighteen feet can be carried, at low tide, to Swansons Creek, 24 miles above the mouth, and no obstruction to 9-foot navigation is now encountered below Bristol bar, opposite Bristol Landing. At Mount Calvert, about 1 mile below Bristol Landing, the river is crossed by the bridge of the Washington and Chesapeake Beach Railway.

A survey of Bristol and Swann Point bars in the Patuxent River was made in 1887, a report of which will be found in the Annual Report of the Chief of Engineers for 1888, pages 846–851. Bristol bar then had a ruling depth of about 8 feet and Swann Point bar of about 7.8 feet.

The original project for the improvement, adopted in 1888, provided for dredging channels 200 feet wide and 12 feet deep through Bristol and Swann Point bars at an estimated cost of \$80,000. This project was modified in 1890 so as to provide for a channel 120 feet wide and 12 feet deep (then already dredged) at Bristol bar and a channel about 100 feet wide and 9 feet deep at Swann Point bar.

The sum of \$10,617.30 was expended under these projects, the latter being completed in 1891.

A new survey of Bristol bar was made in 1899, the report of which was printed as House Document No. 170, Fifty-sixth Congress, first session, and also in the Annual Report of the Chief of Engineers for 1900, pages 1739–1743. The channel and turning basin had shoaled and narrowed considerably since the completion of the work in 1891.

The present project for this improvement was adopted by act of Congress of June 13, 1902, and contemplates the dredging of a channel through Bristol bar 100 feet wide and 10 feet deep, with a turning basin of the same depth, 300 feet wide and 400 feet long at the steamboat wharf, at an estimated cost of \$10,500.

No money has as yet been expended under the present project.

The maximum draft that could be carried June 30, 1903, at mean low water, over the shoalest part of the locality under improvement was about 7.5 feet; the mean range of tide is about 2.3 feet.

Accurate and definite statistics of trade have been difficult to obtain, but it is estimated that the value of receipts and shipments is about \$150,000 per annum, and that the annual number of passengers is about 1,200.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives, the Board of Engineers for Rivers and Harbors has considered the project for this work and has submitted a special report thereon, which will be found by reference to Appendix L 4, herewith.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1888 and 1890.

July 1, 1902, balance unexpended	\$9,382.70
June 30, 1903, amount expended during fiscal year	5,996.03
July 1, 1903, balance unexpended	3,386.67
{ Amount (estimated) required for completion of existing project	37,980.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	"6,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 4.)

5. *York River, Occoquan, Lower Machodoc, Nandua, Aquia, and Carters creeks, Virginia.*—(a) *York River.*—York River, which is formed by the confluence of the Mattaponi and Pamunkey rivers at Westpoint, Va., is 41 miles long and discharges into Chesapeake Bay about 16 miles above Old Point Comfort. Entering the river, 24 feet can be carried for 32 miles, or up to Potopotank bar, 9 miles below Westpoint. In 1880 the ruling depth on this bar was 18.5 feet. Westpoint bar, the next obstruction to navigation, commences about 2 miles below and extends up to Westpoint. Before improvement it had a ruling depth of 15.5 feet.

A survey of York River was made in 1879, a report of which is printed in the Annual Report of the Chief of Engineers for 1880, pages 897–900.

The original project for improvement, adopted in 1880, proposed dredging channels 22 feet deep and 200 feet wide through the bars. In 1884, on account of growth of trade, the width was increased to 400 feet, and in 1887 the project was further amended to include construction of a dike along the right bank at Westpoint bar to maintain the channel. Total cost of the revised, which is the present, project, \$308,800.

The amount expended to June 30, 1903, was \$239,620.97, of which about \$60,000 has been applied to maintenance. This expenditure has resulted in a dredged channel 105 feet wide and 22 feet deep at Potopotank, and one 22 feet deep and 160 to 260 feet in width at Westpoint bar. A training dike 10,142 feet long has been constructed at Westpoint bar, and examinations of the channel made subsequent to its construction show that the channel dimensions obtained by dredging are now being maintained.

The maximum draft that could be carried on June 30, 1903, at mean low tide, over the shoalest part of the locality under improvement was about 20 feet. The mean range of tides is about 3 feet.

A large and important commerce has been benefited by this improvement. Westpoint was for years the cotton-shipping point of the Southern Railway Company. In 1896 this company established a new shipping point near Norfolk, Va., and freight carrying on the York River fell off considerably.

While the amount of river commerce is still below what it was prior to 1896, extensive new industries have been and are being established at Westpoint, and there is a demand for the widening of the channels to their full projected width, with a depth of at least 20 feet.

^a For continuing improvement of Breton Bay.

The following table shows the tonnage of the river from 1888 to 1894:

Reported for—	Tons.	Reported for—	Tons.
1888	285, 480	1892	345, 559
1889	328, 353	1893	351, 390
1890	418, 190	1894	379, 808
1891	304, 338		

Repeated efforts have been made to procure commercial statistics for the years 1895–1901, but without success. Statistics received for 1902 were incomplete, the tonnage of one line of steamers aggregating about 62,000 tons. Much additional freight was carried by other steamers, sailing vessels, barges, etc.

The additional work proposed is for the purpose of extension of benefits and preservation of the work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1886, 1887, and 1894.

(b) *Occoquan Creek*.—Occoquan Creek is a tributary of the Potomac River, which it enters about 25 miles below Washington, D. C. The stream is navigable from its mouth, at Sandy Point, to the town of Occoquan, a distance of 4 miles. A survey of Occoquan Creek was made in 1872, and a report of the same is printed as Senate Executive Document No. 25, Forty-second Congress, third session, and also in the Annual Report of the Chief of Engineers for 1873, pages 819–821 and 825–826.

At the time of the adoption of the original project in 1873 navigation was obstructed by three bars, designated as Lower Mud, Upper Mud, and Sand bars, over which but 1.2 feet could be carried at low tide. The project of 1873 provided for dredging channels 100 feet wide and 5 feet deep through these three bars, and was modified in 1879, so as to include a new channel through, and a dike at, the Sand bar, and the dredging of a channel of the above dimensions through Occoquan bar. Four appropriations were made from 1873 to 1878, amounting to \$25,000, and in 1880 the improvement was regarded as completed.

A new survey of the creek was made in 1889, which showed that the channels dredged through Lower Mud, Sand, and Occoquan bars had all filled in from 2 to 3 feet since 1880. The report of this survey was printed as House Executive Document No. 75, Fifty-first Congress, first session, and also in the Annual Report of the Chief of Engineers for 1890, pages 1089–1096.

The present project for this improvement was adopted in 1890, and contemplates the dredging of channels 6 feet deep and 100 feet wide through the four bars, except the lower 2,000 feet of the Lower Mud bar, where the width is to be 150 feet, and the construction of dikes at Upper Mud, Sand, and Occoquan bars to maintain the depth obtained by dredging. The estimated cost of this project is \$45,000.

The amount expended under the present project to June 30, 1903, was \$24,950.70, of which about \$11,000 was applied to maintenance. As a result of this expenditure channels of the full projected dimensions have been dredged through the four bars and redredged where shoaling occurred, and 1,585 linear feet of dike has been constructed at Occoquan bar and Sand bar and repaired where injured by freshets.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the locality under improvement was about 5½ feet. The ruling depth on the bar in Occoquan Bay is,

however, but about 5 feet. Although the improvement of this bar is not contemplated by the present project, it prevents the full advantages of the improvement from being obtained, and an increase of depth over it is regarded as desirable. The mean range of tide is about 2 feet.

The work done under the appropriations for this improvement has been of material benefit to the trade and commerce connected with this locality by increasing the original ruling depth of 3 feet at low tide to 6 feet, thus obviating the delays due to waiting for tides and increasing the available draft of vessels navigating the creek. In this connection attention is invited to the appended comparative table of commercial statistics. The articles carried through the channel are mostly sand (for building), railroad ties, piles and wood, coal, fertilizers, flour and grain, and miscellaneous articles, being small in amount.

Receipts and shipments by water.

	Tons.		Tons.
1891.....	8, 205	1898.....	29, 865
1892.....	56, 705	1900.....	69, 400
1894.....	8, 900	1901.....	20, 220
1895.....	10, 475	1902.....	13, 049
1896.....	41, 670		
1897.....	15, 835	Total for ten years.....	274, 324

Of the total tonnage, 109,600 tons was sand.

The additional work proposed is for the purpose of the extension of benefits and preservation of the work already done.

(c) *Lower Machodoc Creek*.—This creek is a tidal estuary on the right bank of the Potomac River, and about 85 miles below Washington, D. C. It has a navigable length of about 4 miles. The width between banks at the mouth is 1 mile and between the 12-foot contours the channel width exceeds 3,000 feet. The lower part of the creek for a distance of $1\frac{1}{2}$ miles above the mouth is three-fourths of a mile to a mile in width, with a navigable depth of 13 feet, affording a safe harbor during northeast to southeast storms.

At the Narrows, 2 miles above the mouth, the stream suddenly contracts to the width of 650 feet, and the channel is obstructed by a sand bar over which but 4 feet could be carried at low tide. This bar has constituted the principal obstruction to navigation.

After passing Narrows bar a depth of 10 to 14 feet is found in the channel, gradually shoaling to about 9 feet near Cupelo Point, 3 miles above the mouth, and thence to about 6 feet at Drum Bay, the head of navigation, 4 miles above the mouth.

The present approved project, adopted November 29, 1892, provides for dredging a channel 150 feet wide and 9 feet deep at low tide through the bar at the Narrows. The estimated cost was originally \$15,000. This estimate was revised in 1897 and reduced to \$11,100.

The amount expended to June 30, 1903, was \$10,498.95, of which it is estimated that \$600 was applied to maintenance of the improvement (redredging).

During the past fiscal year the channel was dredged to the full projected dimensions, so that there now exists as a result of the above expenditure a channel at least 9 feet deep and 150 feet wide entirely through Narrows bar.

The maximum draft that could be carried June 30, 1903, at mean

low tide, over the shoalest part of the locality under improvement was about 9 feet. The mean range of tide is about 1.7 feet.

The benefit to navigation and commerce from the work already done has been considerable, as large sailing vessels and regular lines of steamers now enter the creek, which was impossible previous to the improvement.

Repeated efforts have been made to obtain commercial statistics for this work, but without success.

The work provided for under the present project having been completed, no further appropriation is required for this work.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1889 and 1894.

(d) *Nandua Creek*.—This creek is a small tidal estuary of Chesapeake Bay, which it enters on the eastern shore about 40 miles above Cape Charles. Nandua wharf is practically at the head of navigation of the creek.

A preliminary examination of this creek was made in 1890 or 1891, and the report which was printed in House Executive Document No. 209, Fifty-first Congress, second session, and also in the Annual Report of the Chief of Engineers for 1891, pages 1283–1285, represented the locality to be unworthy of improvement. A survey of the creek was made in 1895, a report of which is printed in the Annual Report of the Chief of Engineers for 1895, pages 1302–1304.

Before improvement the entrance channel to this creek was indirect, narrow, and sinuous, and could only be navigated at mean low water by vessels of 5 feet draft. Within the mouth the channel was sufficient for all commercial needs.

The existing project, approved May 11, 1899, is to secure a direct channel by dredging a distance of 1,200 feet through the bar at the mouth of the creek over a width of 100 feet to a depth of 8 feet at mean low water, at an estimated cost of \$6,000.

The amount expended to June 30, 1903, was \$6,019.07, none of which was applied to maintenance. As a result of this expenditure a channel 1,200 feet long, 75 feet wide, and 8 feet deep at low tide was dredged through the bar at the mouth of the creek. This afforded temporary relief to navigation, but as was anticipated the channel has shoaled so that the maximum draft that could be carried on June 30, 1903, at mean low water, over the shoalest part of the locality under improvement, was again but about 5 feet, as before the improvement was begun.

The maximum amount of commerce reported for any calendar year since the inception of the work of improvement was in 1898, when it amounted to 8,550 tons; the minimum was 1,167 tons in 1900.

A map of the locality is printed in the Annual Report for 1895.

(e) *Aquia Creek*.—Aquia Creek enters the Potomac River 41 miles below Washington, D. C., and is navigable to Wharton Landing, 7½ miles above its mouth. The creek has a well-defined channel 60 to 200 feet wide in its upper part. The depth was originally 2 to 17 feet. At a point called the Narrows, about 4½ miles above the mouth, the stream suddenly expands into a bay 1,000 to 6,000 feet wide, resulting in a continuous shoal on which the depth originally ranged from 2 to 4 feet, increasing to 7 feet near the mouth. About 3 miles above the mouth the creek is crossed by a trestle bridge of the Richmond, Fredericksburg and Potomac Railroad.

A survey of Aquia Creek was made in 1871, a report of which will be found in the Annual Report of the Chief of Engineers for 1872, pages 708-710.

Between 1872 and 1878, \$10,000 was appropriated by Congress and expended in dredging a channel through the shoal portions of the creek between Davis Point (about one-third of a mile below the railroad bridge) and Wharton Landing, the channel being from 40 to 50 feet wide and from 4 to 5 feet deep at low tide.

A new survey of the creek was made in 1889, a report of which was printed as House Executive Document No. 135, Fifty-first Congress, first session, and also in the Annual Report of the Chief of Engineers for 1890, pages 1096-1103. It showed that considerable shoaling had occurred. Subsequent to this survey, on September 19, 1890, a new project was adopted providing for the dredging of a channel 150 feet wide and 8 feet deep between the mouth and the Narrows, and a channel 80 feet wide and 8 feet deep through the bar at the mouth of Austen Creek, at an estimated cost of \$101,278. The project was modified December 4, 1890, to provide for a channel 80 feet wide and 6 feet deep to be dredged between the mouth and the Narrows at an estimated cost of \$40,000, which was later reduced to \$21,000.

Between September 19, 1900, and June 3, 1896, the sum of \$21,000 was appropriated with which the channel was completed to the full projected dimensions during the season of 1897, as stated on page 1194 of the Annual Report of the Chief of Engineers for 1898, and this locality was dropped from the list of improvements. The total amount expended to that time was \$30,536.64.

The river and harbor act of June 13, 1902, contained the following item: "Improving York River, Occoquan, Lower Machodoc, Nandua, Aquia, and Carters creeks, Virginia, sixteen thousand dollars." * * * A preliminary allotment of \$100 was made July 18, 1902, for making examination of the channel of this creek with a view of obtaining data for making recommendation for specific allotment for work of improvement. No further allotment has as yet been made for works of improvement, and hence no work has been undertaken. As no new project is specified, it is understood that the above project of 1890 is to be continued in effect. The cost of restoring the channel to these dimensions is not known.

The mean range of tide is about 1.4 feet, but the ruling depth on June 30, 1903, is unknown.

The trade of Aquia Creek is chiefly in wood, railroad ties, lumber, tobacco, and farm produce, and amounts to about 18,000 to 20,000 tons annually.

No further appropriation is requested at present.

(f) *Carters Creek*.—Carters Creek is a tidal estuary of Rappahannock River, which it enters from the left bank at a point about 10 miles above its mouth, and is navigable by steamers to Irvington.

A survey of the creek was made in 1899, a report of which was printed as House Document No. 185, Fifty-sixth Congress, first session, and also in the Annual Report of the Chief of Engineers for 1900, pages 1747-1752. At that time the entrance to the creek was obstructed by a sand bar, upon which the ruling depth was 10.5 feet. Gallyhook Point, within the creek, rendered navigation difficult near that point.

The present project for this improvement was adopted by act of

Congress of June 13, 1902, and provides for dredging a channel at the mouth to afford a navigable depth at low tide of 15 feet, with a width of 200 feet, including necessary dredging at Crab Point, and the construction of a jetty for the protection of this channel, together with the dredging of a channel 12 feet deep and 100 feet wide at Gallyhook Point, at an estimated cost of \$35,700.

The amount expended to June 30, 1903, was \$11.86, none of which was applied to maintenance.

Proposals for dredging were invited November 3, 1902, but the only bid received was so high as to be prohibitive, hence no work of improvement has been undertaken. Proposals will again be invited early in the ensuing fiscal year.

The maximum draft that could be carried on June 30, 1903, at mean low water, over the shoalest part of the locality under improvement, was about 10.5 feet, and the mean range of tides is about 1.5 feet.

The principal freight shipments consist of oysters, fish, fish guano, fish oil, crabs, lumber, wood, farm produce, and coal, the total being roughly estimated at about 200,000 tons per annum. There is a large passenger trade in Carters Creek, which is also an important harbor of refuge.

The additional work proposed is for the purpose of extension of benefits, and is necessary for the preservation of the channel to be dredged with the funds now in hand.

July 1, 1902, balance unexpended.....	\$17,560.93
June 30, 1903, amount expended during fiscal year	2,449.12
July 1, 1903, balance unexpended	15,111.81
July 1, 1903, outstanding liabilities	86.00
July 1, 1903, balance available	15,025.81
July 1, 1903, amount covered by uncompleted contracts.....	2,250.00
{ Amount (estimated) required for completion of existing project.....	^b 113,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	^b 15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L 5.)

6. *Nomini Creek, Virginia.*—Nomini Creek enters the Potomac River about 82 miles below Washington. In 1872 its navigation was obstructed by a bar of oyster shells and sand at its mouth, over which but 3 feet depth could be carried. After passing the bar the stream widens, and 8 feet could be carried for about $3\frac{1}{2}$ miles to Nomini Ferry, while 5 feet could be carried for about 6 miles above the mouth.

A survey of Nomini Creek was made in 1872, a report of which was printed in Senate Ex. Document No. 25, Forty-second Congress, third session, and also in the Annual Report of the Chief of Engineers for 1873, pages 822–824.

The original project for improvement, adopted in 1873, provided for dredging a channel through the bar 100 feet wide and 9 feet deep, at an estimated cost of \$20,000. In 1879 the width was increased to 150 feet, and in 1885 the project was again modified by increasing the

^a Erroneously reported last year as \$17,097.57.

^b For York River and Occoquan and Carters creeks.

width to 200 feet, and the cost to \$62,500. In 1888 the estimate was increased to \$72,500, the channel having shoaled during suspension of work from 1883 to 1889. In order to maintain the channel the project was again modified in 1890 as follows, which is the present project:

The dredged channel to be 150 feet wide and 9 feet deep; a jetty to be constructed from White Point on the east and one from Cedar Island on the west; dikes to be built inside White Point to check the cross currents. Estimated revised cost, \$72,500. Examination made in 1897 showed that the east jetty should be made 400 feet longer, and that both jetties should be made higher than originally projected, the increased cost bringing the estimate up to \$105,000.

The amount expended to June 30, 1903, was \$67,265.93, of which about \$15,000 was applied to maintenance.

As a result of this expenditure the channel has been dredged to a depth of 9 feet at low tide by a width of 140 to 150 feet, and redredged, and 872 linear feet of the east jetty has been constructed at a height of 4 feet above low tide.

The maximum draft that could be carried on June 30, 1903, at mean low tide, over the shoalest part of the locality under improvement, was about 8.5 feet. The mean range of tide is 1.8 feet.

The shipments generally average from 20,000 to 30,000 tons per annum, and consist mainly of coal, farm produce, grain, lumber, oysters, railroad ties, general merchandise, and wood.

The work done has been of great benefit to navigation, and the additional work proposed is for the purpose of the extension of benefits and preservation of the work already done.

A map of the locality may be found in the Annual Report of the Chief of Engineers for 1889.

July 1, 1902, balance unexpended	\$3, 016. 38
June 30, 1903, amount expended during fiscal year	282. 31

July 1, 1903, balance unexpended	2, 734. 07
--	------------

{ Amount (estimated) required for completion of existing project	35, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	6, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 6.)

7. *Rappahannock River, Virginia.*—The Rappahannock River is navigable from its mouth, in Chesapeake Bay, to Fredericksburg, Va., a distance of 106 miles. The lower part of the river has the character of a tidal estuary, the width varying from 1 to 3.5 miles. The ruling depth at the mouth is 5 fathoms, and this depth holds to Jones Point, 28 miles above, while 17 feet can be carried to within 1 mile of Tappahannock, which is 41 miles from the mouth. Above Tappahannock the river has a tortuous course, and above Port Royal, 29 miles from Fredericksburg, it flows between high banks. The width at Fredericksburg is about 350 feet, gradually increasing to about 1,500 feet at Port Royal. In 1871, prior to the inception of the improvement, 6 feet could be carried to within a mile of Fredericksburg, and thence 4 feet to the town.

The obstructions to navigation before improvement was undertaken were nine bars between Tappahannock and Fredericksburg, over which the ruling depths were from 4 to 10½ feet. Seven of the bars were in

the 12½ miles of river below Fredericksburg. Of these bars, Fredericksburg bar, with a least depth of 4 feet, and Spottswood bar, 4 miles below Fredericksburg, with a least depth of 6 feet, caused the most delay to steamboats and vessels.

A survey of Rappahannock River was made in 1870, a report of which is printed in House Executive Document No. 60, Forty-first Congress, third session.

The original project, approved in 1871, was to secure a channel 100 feet wide and 10 feet deep by dredging and the construction of dikes from Fredericksburg to Tappahannock, the wrecks obstructing the channel to be removed. The first estimate of the cost of this improvement was \$83,760. In 1879 the project was amended so as to provide for dredging a channel 100 feet wide and 10 feet deep through the bars between Fredericksburg and Port Royal, and one 200 feet wide and 15 feet deep between Port Royal and Tappahannock, for a larger class of vessels; the depths secured by dredging to be maintained by a system of wing dams and training dikes to be built of piles and sheet piling, or of piles and brush or logs, the dikes being also required in some cases to secure the dredged material from being carried back into the river.

The total cost of the revised project, which is the present approved project, was estimated at \$381,500.

The amount expended to June 30, 1903, was \$271,258.09, of which about \$80,000 has been applied to maintenance.

This expenditure has resulted in the partial improvement of the seven bars between Fredericksburg and Port Royal by means of dredging and rock excavation, construction of dikes, and removal of wrecks which obstructed navigation.

The maximum draft that could be carried June 30, 1903, at mean low tide over the shoalest part of the locality under improvement was about 8 feet, while 9½ feet could be carried to within 4½ miles of Fredericksburg. The mean range of tide is about 3 feet.

Commercial statistics.

Tonnage for—	Tons.	Tonnage for—	Tons.
1888	83, 600	1897	^a 158, 108
1890	83, 830	1898	^a 166, 586
1892	^a 126, 333	1899	^a 167, 862
1893	^a 141, 750	1900	^a 190, 827
1894	^a 144, 070	1901	^a 213, 408
1895	^a 151, 466	1902	^a 244, 365
1896	^a 161, 196		

The principal articles of commerce are grain, oysters, fertilizers, cattle, farm produce, and general merchandise.

A new line of steamers has been added during the year, and an additional boat is being run by the Weems Line.

At Fredericksburg bar new deposits of sand are formed by each recurring freshet, and the annual reports for a number of years past have referred to the necessity of an annual appropriation of \$7,500 for removal of such deposits from this bar alone.

The additional work proposed is necessary to maintain the improvement in a serviceable condition.

^aFurnished by Mr. William D. Scott, Fredericksburg, Va.

Maps of this locality may be found in the Annual Reports of the Chief of Engineers for 1880, 1881, 1883, 1886, 1887, 1888, and 1890.

July 1, 1902, balance unexpended	\$26,535.09
June 30, 1903, amount expended during fiscal year	5,293.18
July 1, 1903, balance unexpended	21,241.91
July 1, 1903, outstanding liabilities	815.00
July 1, 1903, balance available	20,426.91
July 1, 1903, amount covered by uncompleted contracts	1,806.00
(Amount (estimated) required for completion of existing project	89,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	25,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L 7.)

8. *Urbana Creek, Virginia.*—Urbana Creek enters Rappahannock River from the right bank at a point about 16 miles above its mouth. In 1874 a bar existed outside the mouth, over which but 6½ feet could be carried at low tide. In 1882 a shoal within the creek having a least depth of 7 feet was regarded as an obstruction to navigation.

A survey of the outer bar was made in 1874, a report of which is printed in the Annual Report of the Chief of Engineers for 1875, page 139.

The project for improvement adopted in 1879 comprised excavation of a channel 150 feet wide and 10 feet deep through the outer bar; estimated cost, \$20,000. This project was modified in 1883 to include dredging through the inner bar, and in 1888 to include jetties at the mouth to maintain the channel. The revised estimated cost was \$34,580.

On account of the exposed position of the channel through the outer bar the work suffered from the action of northwesterly winds, which caused shoaling in the channel and a diminution in its width. In April, 1897, a survey was made to determine the extent of change in the channels, and an estimate rendered in June following of the cost of completing the project by dredging and construction of a jetty to protect the channel dredged through the outer bar. This cost, added to the amounts expended to date, increases the estimated cost of the present project to \$70,000.

The amount expended to June 30, 1903, was \$33,500, of which about \$10,500 has been applied to maintenance. As a result of this expenditure there has been dredged a channel 10 feet deep and 150 feet wide through the outer bar, a channel 10 feet deep and 135 feet wide through the inner bar, and a small turning basin 10 feet deep at the steamboat wharf.

The maximum draft that could be carried on June 30, 1903, at mean low tide, over the shoalest part of the locality under improvement was about 8.5 feet. The mean range of tides is 1.5 feet.

The improvement has been of much benefit to commerce and navigation by permitting the entrance of steamers and large sailing vessels. New industries are being established and the commerce of the stream is increasing, as is indicated by the following table of statistics. The principal articles of commerce are oysters, railroad ties, coal, lumber, wood, farm produce, guano, ice, excelsior, and general merchandise.

Commercial statistics.

Calendar year.	Reported by Mr. F. A. Bristow.	Reported by Mr. J. D. Gressitt.
	Tons.	Tons.
1891.....	19,500	22,100
1892.....	20,095	17,125
1893.....	55,885	61,290
1894.....	82,395	88,305
1895.....	66,530	92,320
1896.....	137,485	133,925
1897.....	153,875	181,500
1900.....	179,543	179,414
1901.....	548,250	494,200
1902.....	547,650	538,100

Commercial statistics received for 1898 and 1899 were not in a form to be used.

These statistics are not regarded as entirely correct.

The additional work proposed is for the purpose of the extension of benefits and for the preservation of the work already done.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1889 and 1890.

July 1, 1902, balance unexpended.....	\$778.00
June 30, 1903, amount expended during fiscal year.....	778.00

{ Amount (estimated) required for completion of existing project.....	36,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 8.)

9. *Harbor at Milford Haven, Va.*—Milford Haven is a tidal estuary of Chesapeake Bay, situated on its western shore, near Cherry Point, at the mouth of Piankatank River, and about 35 miles north of Old Point Comfort. The haven is about 4 miles long and from one-half to 1 mile wide. Its general direction is northwest and southeast. The depth in the channel ranges from $6\frac{1}{2}$ to 15 feet, but is generally 7 feet or more. The haven has two entrances, one at the northwest end, at Hills Bay, an arm of the Piankatank River, about 2 miles from Cherry Point, and another at the southeast end, on Chesapeake Bay, about 5 miles below Cherry Point, thus separating from the main shore a considerable body of land known as Gwynns Island. Both entrances are obstructed by bars. The southeast entrance is exposed, and, as the bar has a ruling depth of but 5 feet, is but seldom used. The northwest entrance, from Piankatank River, is the one generally used by vessels and steamers entering the haven, and before improvement the bar obstructing this entrance had a ruling depth of 8 feet. A bar also existed within the haven between Cricket Hill and Callis wharves, with a ruling depth of about 8 feet.

A preliminary examination of Milford Haven was made in 1892, a report of which is printed as House Executive Document No. 59, Fifty-second Congress, second session, and also in the Annual Report of the Chief of Engineers for 1893, pages 1319-1321. A survey was made in 1894, a report of which is printed as House Executive Document No. 299, Fifty-third Congress, third session, and also in the Annual Report of the Chief of Engineers for 1895, pages 1267-1270.

The original which is also the present project for improvement was adopted in 1899, and provided for dredging a channel 10 feet deep, with a minimum width of 200 feet, through the bar at the northwest entrance, at an estimated cost of \$12,500. The dredging of a similar channel through the inner bar was added to the project in 1900, the total estimated cost being increased to \$17,500.

The amount expended to June 30, 1903, was \$11,283.75, none of which was applied to maintenance.

As a result of this expenditure the channel through the outer bar has been dredged to the full dimensions required by the project and a channel 10 feet deep and at least 175 feet wide has been dredged through the inner shoal. This has been of great benefit to navigation.

No further appropriation is regarded as necessary.

The maximum draft that could be carried June 30, 1903, at mean low tide, over the shoalest part of the locality under improvement, was about 10 feet. The mean range of tide is about 1.3 feet.

The value of the commerce of the locality may be seen by reference to the commercial statistics. The principal articles of commerce are oysters, farm produce, fish, flour, and general merchandise.

<i>Commercial statistics.</i>		Tons.
Tonnage for—		
1900.....		15, 031
1901.....		16, 856
1902.....		18, 553
July 1, 1902, balance unexpended.....	\$11, 641. 97	
June 30, 1903, amount expended during fiscal year.....	2, 392. 75	
July 1, 1903, balance unexpended.....	9, 249. 22	

(See Appendix L 9.)

10. *Mattaponi River, Virginia.*—The Mattaponi River is navigable for small steamers and vessels from its mouth to Aylett, about 39 miles, and can be made navigable for small barges from Aylett to Monday bridge, 16 miles. At the time of the adoption of the project the obstructions to a 5½-foot navigation below Aylett consisted of seven bars, upon which the ruling depths at low tide varied from 2.4 to 3.8 feet. Above Aylett there were numerous bars, but no work upon them has been proposed. The river was also obstructed by snags, wrecks, and overhanging trees.

A survey of Mattaponi River was made in 1875, a report of which was printed in the Annual Report of the Chief of Engineers for that year.

The original project for improvement adopted in 1880 provided for removal of snags, wrecks, and leaning trees below Monday bridge, and the improvement of the bars below Aylett, so as to give a depth of 5½ feet at low tide and a channel width of 40 feet. This project was extended by the terms of the river and harbor act of July 13, 1892, which provided for the removal of snags as far up as Guineas bridge, near Milford Station, on the Richmond, Fredericksburg and Potomac Railroad. Estimated cost of this, which is the present, project, \$72,100.

The amount expended to June 30, 1903, was \$29,322.23, of which about \$8,000 was applied to maintenance. This expenditure resulted in the removal of snags, logs, and overhanging trees from the river, between Robinsons bar, 3¼ miles above the mouth, and Monday bridge, 21 miles above Robinsons, and in keeping the river below Aylett free from such obstructions; in constructing 2,297 linear feet of dike at

Robinsons bar, and in dredging channels of the full projected dimensions entirely through Line Tree and nearly one-third of the distance through Latané bar.

The maximum draft that could be carried at mean low water over the shoalest part of the channel, June 30, 1903, was 2.4 feet at Walker bar. The mean range of tide is about 3 feet.

The work already done upon this river has been of benefit to the existing commerce, the amount of which is shown by the following table. As snags and other obstructions form in greater or less degree after every freshet, much of the work done has had to be gone over again. Before any work for improvement was undertaken the trade was limited.

The additional work proposed is for the purpose of extension of benefits.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

Tonnage by years.

	Tons.		Tons.
1890	32,650	1899	44,700
1891	52,060	1900	42,500
1892	32,690	1901	12,054
1893	36,420	1902	^a 270,045
1894	39,300		

Commercial statistics for the years 1895-1898 could not be procured.

July 1, 1902, balance unexpended	\$637. 29
Amount allotted from appropriation for emergencies in river and harbor works, act of June 6, 1900.....	800. 00

June 30, 1903, amount expended during fiscal year	1,437. 29
	159. 52

July 1, 1903, balance unexpended	1,277. 77
--	-----------

{ Amount (estimated) required for completion of existing project	42,300. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	3,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 10.)

11. *Pamunkey River, Virginia.*—The Pamunkey River is navigable from its mouth at Westpoint, on York River, to Hanover town, a distance of about 59 miles. At the time of the adoption of the project a draft of 7 feet could be carried at low water to Buckland bar, 38½ miles above Westpoint. Above this bar there were six bars, extending along the river for about 15½ miles, the ruling depths on which varied from 5½ to 2 feet. Besides these bars, the river was obstructed by wrecks, logs, snags, and overhanging trees.

A survey of Pamunkey River was made in 1875, a report of which was printed in the Annual Report of the Chief of Engineers for that year.

The project for improvement, adopted in 1880 and amended in 1885, contemplates 7-foot navigation to Bassett Ferry, 47 miles from Westpoint; thence 5 feet to Wormley Landing, 54 miles; thence 3 feet to

^a The only statistics obtained; this amount is believed to be in excess of the actual tonnage of the river.

Hanover town, the 7-foot channel to have a width of 100 feet and the other channels 40 feet. The wrecks, snags, logs, and trees obstructing navigation between Garlick Ferry and Hanover town were also to be removed. The cost of this amended project, which is the present project, was estimated at \$32,500.

The amount expended to June 30, 1903, was \$25,115.57, of which about \$5,000 was applied to maintenance. This expenditure has resulted in removing snags and similar obstructions from about 30 miles of river, in removing parts of seven wrecks, in partly improving Spring and Skidmore bars, and in dredging a channel 100 feet wide and 7 feet deep through Buckland bar.

The maximum drafts that could be carried through the channels on June 30, 1903, at mean low tide were as follows: In the 7-foot channel, 5.3 feet; in the 5-foot channel, 3.5 feet, and in the 3-foot channel, 2.2 feet. The mean range of tide varies from 2 to 3.5 feet.

The commerce of this river amounted, according to reports received, to 50,420 tons in 1893 and 42,250 tons in 1894, the greater part of the latter being railroad ties and wood. There is scarcely any trade on the 5 miles immediately below Hanover town. The tonnage of the river for 1899 is stated as about 44,600 tons. Commercial statistics for the years 1895 to 1898 and 1900 to 1902 could not be obtained.

The additional work proposed is for the purpose of extension of benefits.

Maps of the locality may be found in the Annual Reports of the Chief of Engineers for 1887, 1888, and 1890.

July 1, 1902, balance unexpended	\$570. 50
Amount allotted from appropriation for emergencies in river and harbor works, act of June 6, 1900.....	1, 000. 00
June 30, 1903, amount expended during fiscal year	1, 570. 50
	186. 07
July 1, 1903, balance unexpended	1, 384. 43
{ Amount (estimated) required for completion of existing project.....	7, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 11.)

12. *James River, Virginia.*—Improvement of this river was not regularly undertaken by the United States until 1870. At that time the condition of the river was as follows:

Between the mouth of the Appomattox and Richmond, then a distance of 35 miles, instead of 30 miles, as at present, the canal at Dutch Gap not then being navigable, the ruling depth at mean low tide was 7 feet, that depth obtaining on Rocketts reef at Richmond and on Richmond bar, 2 miles below. The channel was close and indirect at some points, and was obstructed in Trents reach, in the bend just above Dutch Gap, 17½ miles below the city, by a shoal on which only 8 feet could be carried, and by obstructions placed during the civil war by the United States.

The channel was also obstructed by wrecks at Graveyard reach and Chaffins Bluff, 10 miles and 8 miles, respectively, below Richmond.

The channel at Drewry Bluff and Warwick bar, situated about 7 and 4½ miles, respectively, below the city, was almost impassable on

account of obstructions placed during the civil war, consisting at each locality of the remains of a military bridge, lines of stone cribs, and sunken vessels.

The ruling depth in the reach between the mouths of the James and the Appomattox, a distance of 69.4 miles, was 15 feet on Harrisons bar, about 38 miles below Richmond, and on Goose Hill flats, 71 miles below.

The original project was to give 18 feet depth at full tide to Richmond, with a channel width of 180 feet from Harrisons bar to the city docks, the excavation in rock to be to a depth of $18\frac{1}{2}$ feet. The average rise of tide is $2\frac{1}{2}$ feet. Work under this project had been well advanced when Congress, in act of July 5, 1884, adopted another to afford 22 feet of depth at mean low tide from Richmond, the head of navigation, to the mouth, the widths to be given the improved channels to be 400 feet from the mouth to City Point, 300 feet thence to Drewry Bluff, 200 feet thence to Richmond. The consequent estimated cost of the improvement was \$4,500,000. A large part of the excavation has been and will be through solid rock, the cost necessarily being heavy. Operations consist in dredging, rock excavation, and regulation of the waterway by means of dikes and jetties.

The mean rise of tide at Richmond is 3 feet.

The work has generally been done first on the shoalest places in the channels, with a view to benefit of commerce.

The appropriation of \$300,000 made by the act of June 13, 1902, was applied mainly to continuing the improvement from the lower city line downstream to include Warwick reach, about 5 miles below the city; to enlarging the low-water section of Dutch Gap Canal; and to commencement of channel improvement between the lower city line and the docks at the upper end of Richmond Harbor. The section of Dutch Gap Canal had been much encroached upon by a landslide in May, 1902. Work upon the canal, however, was held in abeyance, awaiting action by the city of Richmond upon the question of ownership of the area from which the slide had occurred and of enough land to enable the United States to execute the necessary work for channel improvement and protection. The land, or at least the greater part of it, had been supposed, for the past twenty-five or thirty years, to have been deeded to the United States by the city of Richmond in or about 1870, for purposes of river improvement. It is on record to that effect. There now appears to have been some oversight in the records. If the projected improvement can not be pushed as it should be and as it is the wish of the Government to have it done, the commercial interests of Richmond which depend upon the continuity and maintenance of channel depths in the James may suffer.

The extension of the improvement from the lower city line to the docks was provided for in the river and harbor act of June 13, 1902, the extension to be in accordance with the report of survey submitted in House Document No. 234, Fifty-sixth Congress, first session (see Annual Report of the Chief of Engineers for 1900, p. 1754), provided that no part of said amount should be expended for turning basins or areas mentioned in that report. The cost of this extension is estimated at \$724,943.15.

With the published report just mentioned was a large map of Richmond Harbor.

The sum expended to June 30, 1903, \$1,910,661.18, resulted in

channel depths of 17½ to 18 feet by widths of 90 to 100 feet, excepting near the lower city line, where the maximum depth is 16½ feet.

The sum asked for the fiscal year ending June 30, 1905, is to be applied to work under the approved project.

The value to commerce of improvement of the river is shown by the following table of river tonnage between 1890 and 1902:

	Tons.		Tons.
1890	743, 122	1897	661, 909
1891	739, 308	1898	472, 778
1892	616, 755	1899	571, 802
1894	616, 269	1900	609, 411
1895	602, 582	1901	652, 451
1896	680, 935	1902	549, 310

July 1, 1902, balance unexpended	\$330, 050. 96
June 30, 1903, amount expended during fiscal year	18, 212. 14

July 1, 1903, balance unexpended	311, 838. 82
July 1, 1903, outstanding liabilities	1, 240. 00

July 1, 1903, balance available	310, 598. 82
---------------------------------------	--------------

July 1, 1903, amount covered by uncompleted contracts	232, 082. 00
---	--------------

{ Amount (estimated) required for completion of existing project	3, 742, 443. 15
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	175, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L 12.)

13. *Protection of Jamestown Island, Virginia.*—The protection work provided for by the appropriation of June 3, 1896, was completed November 16, 1901. It consisted of 1,310 linear feet of sloping concrete wall. For more extended account see page 218, Appendix K, Annual Report, 1902, and pages 1736–1738, Appendix L, Annual Report, 1900.

The protection of this island can not be said to be necessary to the improvement or conservation of the navigation of James River.

July 1, 1902, balance unexpended	\$322. 15
June 30, 1903, amount expended during fiscal year	7. 40

July 1, 1903, balance unexpended	314. 75
--	---------

(See Appendix L 13.)

14. *Removing sunken vessels or craft obstructing or endangering navigation.*—*Wreck of tugboat Daisy in Carters Creek, Virginia.*—This wreck having been reported as an obstruction to navigation, an examination of the same was made May 23, 1902.

In September, 1902, the wreck was removed by hired labor and use of the United States snagboat at a total cost of \$165.32.

Wreck of unknown vessel in Potomac River near River View wharf.—This wreck having been reported as an obstruction to navigation, an examination of the same was made January 29, 1903.

On February 10, 1903, the wreck was removed by hired labor at a total cost of \$82.27.

Wreck of schooner Anna M. Harris in York River, Virginia.—This wreck having been reported as an obstruction to navigation, an examination of the same was made December 28, 1902.

The wreck was broken up by hired labor with dynamite in March, 1903, at a total cost of \$401.01.

(See Appendix L 14.)

IMPROVEMENT OF NORFOLK HARBOR, VIRGINIA, AND ITS APPROACHES,
AND OF CERTAIN WATERWAYS AND HARBORS IN SOUTHEASTERN
VIRGINIA AND NORTHEASTERN NORTH CAROLINA.

This district was in the charge of Lieut. Col. James B. Quinn, Corps of Engineers, until May 1, 1903, and of Capt. E. Eveleth Winslow, Corps of Engineers, since that date. Division Engineers, Col. Peter C. Hains, Corps of Engineers (now brigadier-general, United States Army), until January 29, 1903, and Lieut. Col. James B. Quinn, Corps of Engineers, since May 1, 1903.

1. *Harbor at Norfolk and its approaches, Virginia.*—(a) *General improvement.*—Originally the channel of the harbor was available at mean low water for vessels drawing 20 feet as far as the navy-yard, near Norfolk. To wharves on the Eastern Branch a good 15-foot channel at mean low water existed.

The project approved in 1885, with amendments of 1890, covers the attainment of a channel 25 feet deep at mean low water from Hampton Roads to the navy-yard and 22 feet deep at the same stage of the tide in the Eastern Branch as far as the Campostella bridge, dredging to be carried to within 75 feet of the pierhead lines on each side of the river, above the mouth of the Western Branch, and below it over a width of 500 feet. An anchorage was also to be provided by dredging an area of 56 acres to a depth of 25 feet at mean low water. The work contemplated was estimated to cost \$1,041,774.56.

With the expenditure of \$983,034.84 all of the work projected has been finished, with the exception of dredging between the Norfolk and Western Railway and Campostella bridges, which is not warranted by the present commercial interests of that section, and the removal of a portion of Berkley flats.

Under a project adopted July 21, 1898, a channel having a depth at mean low water of 28 feet over a width of 450 feet was excavated from deep water in Hampton Roads to the navy-yard, at an expense of \$359,516.42.

On June 30, 1903, a vessel of 28 feet draft could navigate the channel at mean low water to the navy-yard; and, in the Eastern Branch, a vessel drawing 22 feet could, at mean low water, go as far as the Norfolk and Western Railroad bridge. The tidal variations average 2.7 feet.

The commerce is general in character. In 1888 1,914,506 tons was transported by water, and this amount has gradually increased to 7,853,108 tons in the calendar year 1902.

The work to be done at Berkley flats is warranted and should be performed for the benefit of the shipping interests, which should have a wider and a deeper channel than exists at present. The anchorage area of the harbor is insufficient, and, to prevent interference with navigation due to vessels having to anchor at certain localities, encroaching upon the channels, its enlargement in the interests of commerce is essential.

220 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

July 1, 1902, balance unexpended.....	^a \$23,252.95
June 30, 1903, amount expended during fiscal year	1,287.79
July 1, 1903, balance unexpended	21,965.16
July 1, 1903, outstanding liabilities	47.08
July 1, 1903, balance available	21,918.08
{ Amount (estimated) required for completion of existing project.....	^b 36,774.56
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(b) *Hospital Point*.—The land of this point is the property of the United States and is a part of the naval hospital grounds under the control of the Navy Department. The channel of Norfolk Harbor is just off the wharf on the point, and it has a depth of 25 feet at mean low water, except over a width of 450 feet which has been dredged to a depth of 28 feet at mean low water.

The project for this work, approved August 9, 1902, calls for cutting back the point a distance of 400 feet from the channel face of the wharf and dredging on either side parallel with the established pierhead line to within 75 feet of it as far as the Seaboard Air Line wharf on the south and the Atlantic Coast Line wharf on the north; also the rebuilding of the wharf and stone wall to be demolished in cutting back the front. The depth to be secured in this dredging is the same as that of the harbor channel—25 feet at mean low water. The work under the project is estimated to cost \$193,957.

At the close of the fiscal year no work had been done, other than on plans and specifications, the latter being issued June 16, 1903. The expenditures to June 30, 1903, amounted to \$1,469.25 for contingencies.

The statements made under the section of this report styled "general improvement" as to present channel depth and commerce apply equally well to this section. The available funds will be expended under contract for work performed in accordance with the adopted project.

July 1, 1902, balance unexpended	^c \$10,000.00
Amount appropriated by sundry civil act approved March 3, 1903	183,957.00
	193,957.00
June 30, 1903, amount expended during fiscal year	1,469.25
July 1, 1903, balance unexpended	192,487.75
July 1, 1903, outstanding liabilities	70.50
July 1, 1903, balance available	192,417.25

(See Appendix M 1.)

2. *Western Branch of Elizabeth River, Virginia*.—The channel of the river, when the project for improvement was adopted, was 12 feet deep at mean low water and 50 to 300 feet wide.

The adopted project provided for obtaining, by dredging, a channel

^a Balance reported last year included \$10,000 for "Hospital Point, Virginia," q. v.

^b The appropriation of \$20,000 by act of June 13, 1902, was considered to be for new work. It having been decided that there was no authority to so apply the amount, this sum has been deducted from estimate, as a corresponding amount was added last year under the misapprehension that an increase was authorized. Estimate for completion, submitted with Report for 1902, also included \$183,957 for "Hospital Point, Virginia," which is now a separate section of the current report.

^c Included in statement for Harbor at Norfolk, Va., in last Annual Report.

200 feet wide and 20 feet deep at mean low water from deep water in Norfolk Harbor for a distance of about 1 mile, at an estimated cost of \$45,000. This project was approved September 2, 1896.

The sum of \$44,666.73 had been expended on the improvement to June 30, 1903, the result being the completion of the project.

A draft of 20 feet could be carried at mean low water in the improved channel at the close of the fiscal year. The average rise and fall of the tide is 2.7 feet.

The commerce, in the main, consists of manufactured lumber, and farm products, and had increased from 211,653 tons in 1896 to 1,383,105 tons in 1901. It is reported for the calendar year 1902 at 1,058,488 tons.

The channel is ample in depth, but it may be necessary to widen it in the near future to accommodate the increasing commerce and provide anchorage space to relieve the overcrowded condition of the area designated for that purpose in Norfolk Harbor.

July 1, 1902, balance unexpended	\$333. 27
July 1, 1903, balance unexpended	333. 27

(See Appendix M 2.)

3. *Hampton Roads, Virginia.*—When the project for improvement was adopted, the channel over the width it is proposed to excavate had a minimum depth at mean low water of 25½ feet. The existing project, adopted June 14, 1902, requires the dredging of a channel through Middle Ground bar to a depth of 30 feet at mean low water over a width of 500 feet. The cost of such a channel was estimated at \$225,000, which amount has been provided to complete the project.

At the close of the fiscal year no work had been done. The expenditures had amounted to \$1,046.17, for contingencies. A contract was entered into May 18, 1903, covering all the dredging to be done in connection with the execution of the adopted project. Operations thereunder will be commenced early in the next fiscal year.

On June 30, 1903, a vessel drawing 25½ feet could navigate the channel now existing across the bar. The tidal variations averaged 2.6 feet.

The commerce interested in the improvement includes foreign and coastwise trade. It amounted to 2,663,669 tons in the calendar year 1902, which is over a million tons less than that given for the previous calendar year. This decrease is accounted for by the small amount of coal handled at Newport News during the period last named, by reason of the mines, which are located along the Chesapeake and Ohio Railroad, not being operated during a strike of the miners.

The available balance of funds is to be applied to dredging under contract.

July 1, 1902, balance unexpended	\$10,000. 00
Amount appropriated by sundry civil act approved March 3, 1903	215,000. 00
	225,000. 00
June 30, 1903, amount expended during fiscal year	1,046. 17
July 1, 1903, balance unexpended	223,953. 83
July 1, 1903, outstanding liabilities	376. 81
July 1, 1903, balance available	223,577. 02
July 1, 1903, amount covered by uncompleted contracts	202,500. 00

(See Appendix M 3.)

4. *Nansemond River, Virginia.*—The original channel of this stream permitted it to be navigated at mean low water by vessels drawing not over 5 feet. This depth was increased to 8 feet at the same stage of tide under appropriations made between 1873 and 1878 aggregating \$37,000.

The project under which the work has been carried on until recently was approved December 18, 1888, and called for a channel from Suffolk to the Western Branch, 100 feet bottom width, and from the latter place to Town Point from 200 to 400 feet wide. The depth to be obtained throughout is 12 feet at mean low water. This channel was estimated to cost \$152,500.

At present it is contemplated to provide a channel only 80 feet wide and 12 feet deep at mean low water between Suffolk and Town Point, which is deemed ample for the commerce of the stream, it having lately decreased materially. To complete such a channel a further appropriation of \$1,000, in addition to the amount in hand, is required, which will make the cost of the 80-foot channel, with a depth of 12 feet at mean low water, \$51,000.

The expenditures under the project of 1888 and its modification amounted to \$40,677.11 on June 30, 1903.

The channel between Suffolk and the Western Branch has been dredged to 80 feet in width and 12 feet deep at mean low water, and a turning basin excavated at the former place. In the fiscal year just closed some work was done in maintaining this channel by removal of sunken logs, \$500 being expended on work of that character.

At the close of the fiscal year a boat drawing 9.5 feet at mean low water could reach Suffolk, the head of navigation. The tidal variations are about 3 feet at Town Point and 3.8 feet at Suffolk.

The commerce of the stream consists principally of lumber and merchandise, and of late years has gradually decreased. In 1888 it is reported to have reached nearly 110,000 tons, while for the last calendar year it amounted to only 50,950 tons.

The amount of funds estimated for completing the present project will be applied to removing shoals below the Western Branch.

July 1, 1902, balance unexpended	\$9,869.94
June 30, 1903, amount expended during fiscal year	547.05

July 1, 1903, balance unexpended	9,322.89
--	----------

{ Amount (estimated) required for completion of existing project	1,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	1,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix M 4.)

5. *Pagan River, Virginia.*—Originally the shoals in this stream limited the draft of vessels to 6½ feet at mean low water. The sum of \$10,000 was expended in dredging a channel 60 feet wide and 8 feet deep at mean low water, through three shoals between the mouth and Smithfield, under a project submitted August 26, 1880.

The project in the present instance provides for dredging a channel through such shoals as may be necessary, 80 feet wide and 8 feet deep at mean low water, at an estimated cost of \$28,870. This project was adopted June 13, 1902.

At the close of the fiscal year the expenditures thereunder amounted to \$6.95 for contingent expenses, no actual operations having been carried on.

Vessels are limited to a draft of 6½ feet in navigating the river at mean low water by numerous shoals. The average tide is 2.6 feet, which is the same throughout the course of the stream covered by the project.

The commerce in the calendar year 1901 amounted to 108,058 tons. It was somewhat less during the calendar year 1902, being reported at 75,614 tons.

The head of navigation on the river is Smithfield, which is about 8 miles from the mouth.

The work as contemplated under the present project is required by the commerce on the river.

July 1, 1902, balance unexpended	\$10,870.00
June 30, 1903, amount expended during fiscal year	6.95

July 1, 1903, balance unexpended	10,863.05
--	-----------

{ Amount (estimated) required for completion of existing project	18,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix M 5.)

6. *Appomattox River, Virginia.*—(a) *Maintenance.*—The original channel in this river was narrow and tortuous and numerous shoals prevented vessels drawing in excess of 6½ feet from navigating it at mean high water.

The existing project was approved in 1893 and covers the attainment and maintenance of a channel 80 feet wide and 12 feet deep at mean high water. To provide this channel an estimate of \$473,920 was made and the maintenance put at \$10,000 annually.

On June 30, 1903, the sum of \$423,830 had been expended toward improvement, and for maintenance the sum of \$16,505.64.

The channel depth at the close of the fiscal year 1903 was slightly in excess of 8 feet at the shoalest point. The average tide at Point of Rocks is 2.7 feet, and at the town of Petersburg, the head of navigation, 2.6 feet.

The commerce in 1888 amounted to 30,626 tons, and for the calendar year 1902 it amounted to 100,668 tons, which is slightly less than during the previous year. The decrease is thought to have been caused by the many heavy freshets which occurred during the year 1902, which prevented any dredging being done to remove the shoals thus formed. The present commerce warrants the continuance of the work, and it is probable that the accomplishment of the project for the diversion of the water of the river may overcome the difficulty encountered in the past in the improvement of this stream, although it is not expected that the channel will be self-sustaining after the completion of that work, but that redredging will not be required as frequently as in the past.

July 1, 1902, balance unexpended	^a \$7,510.63
June 30, 1903, amount expended during fiscal year	1,518.27
July 1, 1903, balance unexpended	5,994.36
July 1, 1903, outstanding liabilities	1,069.31
July 1, 1903, balance available	4,925.05

(Amount (estimated) required for completion of existing project	^b 48,090.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(b) *At Petersburg.*—The project for the work contemplated is not to provide a navigable channel, but to excavate a cut into which to deflect the river to overcome the trouble experienced in preventing the deterioration of the navigable channel of the river through the deposit of sediment brought down by the swift current during periods of heavy freshets.

The project for this work, which was adopted June 13, 1902, contemplates the excavation to mean low water of a cut 200 feet in width and 2½ miles long, from above the trestle bridge of the Richmond and Petersburg Railroad, to divert the river into the said cut, by means of an earthen dam built across the river above the bridge; and to provide bridges for the highway and railway crossing the new channel. The amount authorized for the work is \$200,000.

At the close of the fiscal year 1903 the sum of \$1,511.04 had been expended in connection with the investigation and plans for the work contemplated under the project.

Negotiations have been carried on with the view to the purchase or condemnation of the land through which the cut is to be excavated.

The difficulty in obtaining reasonable figures for this property from the owners along the line of the cut has delayed the starting of the actual work longer than was anticipated. The work to be done is in the interest of the commerce referred to in the preceding section, and all statements upon this subject therein apply equally well to this improvement.

July 1, 1902, balance unexpended	\$25,000.00
Amount appropriated by sundry civil act approved March 3, 1903	175,000.00
	200,000.00
June 30, 1903, amount expended during fiscal year	1,511.04
July 1, 1903, balance unexpended	198,488.96
July 1, 1903, outstanding liabilities	6.00
July 1, 1903, balance available	198,482.96

(See Appendix M 6.)

7. *Harbor at Cape Charles City, Va.*—This harbor covers an area of about 10 acres and had a depth of 12 feet at mean low water. The project as approved November 13, 1892, requires the dredging of a channel through Cherrystone Inlet and over the bar, 200 feet wide and 16 feet deep at mean low water; the dredging of an entrance chan-

^aBalance July 1, 1902, as given in Report for 1902, included \$25,000 for work "At Petersburg."

^bEstimate in Report for 1902 included \$175,000 for work "At Petersburg."

nel 100 feet wide to the same depth and dredging over the entire area of the protected and inclosed harbor to a depth of 14 feet at mean low water; jetties of stone to be constructed for the protection of the channel leading into the basin. This work was estimated to cost \$142,340.

The expenditures to June 30, 1903, amounted to \$55,251.34, resulting in the dredging of one-half of the inner harbor to the proper depth and the excavation of channels of the required dimensions through the inlet and bar and the construction of 875 feet of the north jetty and 232 feet of the south jetty. The north jetty is 1,625 feet in length, but 750 feet of this was built without expense to the United States. The channels have shoaled considerably and vessels are now limited to a draft not exceeding 11 feet when navigating them at mean low water. The range of the tide is 2.5 feet.

The commerce in the main consists of fertilizer, miscellaneous freight, and a small quantity of oysters and fish. It amounted to 1,031,598 tons in the calendar year 1902. At the inception of the improvement the commerce amounted to 390,207 tons.

The head of navigation is at Cape Charles City, where the channel terminates in an artificial basin.

July 1, 1902, balance unexpended	\$20, 292. 74
June 30, 1903, amount expended during fiscal year.....	544. 08
July 1, 1903, balance unexpended	19, 748. 66
July 1, 1903, outstanding liabilities	50. 83
July 1, 1903, balance available.....	19, 697. 83
July 1, 1903, amount covered by uncompleted contracts.....	18, 000. 00
{ Amount (estimated) required for completion of existing project.....	67, 340. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix M 7.)

8. *Waterway from Norfolk, Va., to the sounds of North Carolina.*—The route courses from Norfolk, Va., via the Southern Branch of the Elizabeth River to Deep Creek, thence by way of the latter to the locks of the Dismal Swamp Canal, through that canal to South Mills, and from the latter point through Turners Cut to the Pasquotank River and Albemarle Sound, and thence to Pamlico Sound by Croatan Sound.

The draft which could be carried through this waterway at the time of the adoption of the project for improvement was limited to 2½ feet at mean low water owing to the deterioration of the Dismal Swamp Canal, which originally had a depth of about 6 feet.

The existing project, approved May 11, 1899, is to obtain channels in Deep Creek and Turners Cut 100 feet wide and 10 feet deep, and through a shoal in the Pasquotank River near Shipyard bar a channel of the same dimensions, and to dredge a channel 12 feet deep at mean low water and 200 feet wide through a bar near Croatan light in Croatan Sound. It also covered the placing of sheet piling where necessary for the protection of the banks in Turners Cut. The cost of this work was estimated at \$274,310.

To the close of the fiscal year 1903 the sum of \$251,196.46 had been expended.

The dredging contemplated at all the localities had been performed and the sheet piling erected in Turners Cut.

On June 30, 1903, vessels drawing 10 feet of water could navigate from Norfolk, Va., through all the improved sections of the route at mean low water. The canal, which extends from Deep Creek to South Mills, was improved at the expense of a private corporation so as to accommodate the same draft. Deep Creek is the only tidal portion of the improvement where the rise and fall averages 3 feet, and in the other sections the water level changes according to the direction and velocity of the wind.

The commerce of the route, which amounted to 214,263 tons during the calendar year 1901, valued at \$1,485,409, was reported to have increased during the calendar year 1902, being valued during the latter period at \$2,502,161.

The draft of vessels which could use this route on June 30, 1903, was limited to 9 feet, owing to the existence of shoal places in the canal.

July 1, 1902, balance unexpended.....	\$13,351.25
June 30, 1903, amount expended during fiscal year	9,677.71

July 1, 1903, balance unexpended	3,673.54
--	----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	3,000.00

(See Appendix M 8.)

9. *Inland water route from Norfolk, Va., to Albemarle Sound, North Carolina, through Currituck Sound.*—This route extends from Norfolk, Va., to Albemarle Sound, via the Southern Branch of the Elizabeth River, Albemarle and Chesapeake Canal, North Landing River, Currituck Sound, Coanjoek Bay, North Carolina Cut, and North River. The cut and canal mentioned are now controlled by a private corporation.

This route had a good 5-foot mean low-water channel, but navigation was obstructed by snags, sunken logs, and overhanging trees. Sharp bends added to the other difficulties of navigation. Until the act of September 19, 1890, the work of improvement was carried on under several separate projects. They were consolidated in one item in that act.

The present project, adopted September 19, 1890, provides for obtaining a channel 80 feet wide and 9 feet deep at mean low water through the whole extent of the waterway to be improved by the United States, at an estimated cost of \$306,667.08. Previous to this \$240,169.69 had been expended on the separate projects, and since then to June 30, 1903, the sum of \$50,287 has been expended.

The channels through the various portions of the route are now from 60 to 80 feet wide, and have a depth of 9 feet at mean low water. The draft of vessels which could pass through the route on June 30, 1903, at mean low water was 9 feet.

There is no lunar tide in any portion of the route except in the Southern Branch of the Elizabeth River, where the average rise and fall is 2.7 feet. In the other sections the water level varies according to the velocity and direction of the wind, for which an allowance of 0.5 of a foot is made, but severe storms may cause an elevation or depression of as much as 2 feet.

The commerce has varied considerably since the route was opened to navigation. The highest being reported was for the calendar year 1890, when it amounted to 403,111 tons. The minimum commerce was reported in 1898, viz, 160,109 tons. For the calendar year 1902 it is given at 199,062 tons.

July 1, 1902, balance unexpended	\$23, 400. 32
June 30, 1903, amount expended during fiscal year	3, 287. 32
July 1, 1903, balance unexpended	20, 113. 00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	1, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M 9.)

10. *Edenton Bay, North Carolina.*—Before improvement, a sand shoal obstructed navigation. The minimum depth was 6½ feet at mean low water.

During the years 1878 and 1879 a channel 100 feet wide and 9 feet deep at mean low water was provided, at a cost of \$5,000.

The present project was approved in 1885, and covers the dredging of a channel 150 to 200 feet wide and 9 feet deep at mean low water, and providing a turning basin 12 acres in area. The cost was limited to \$18,000.

The sum of \$12,156.66 had been expended at the close of the fiscal year ending June 30, 1903, in providing a channel in the bay 150 to 200 feet wide, with a depth of 9 feet at mean low water, and the projected turning basin had been dredged to the same depth over an area of 9½ acres.

A boat drawing 8½ feet could enter the bay at mean low water, June 30, 1903. There is only a slight difference in the ordinary water level, which varies according to the force and direction of the wind.

In 1898 the commerce amounted to 160,109 tons. It was slightly less in the calendar year 1902, having amounted to 149,246 tons.

The head of navigation on this bay is Edenton, to which point the channel extends.

July 1, 1902, balance unexpended	\$6, 140. 63
June 30, 1903, amount expended during fiscal year	297. 29
July 1, 1903, balance unexpended	5, 843. 34
July 1, 1903, outstanding liabilities	46. 30
July 1, 1903, balance available	5, 797. 04

(See Appendix M 10.)

11. *Roanoke River, North Carolina.*—Originally the navigable channel to Indian Highland bar, 67 miles above the mouth, was 10 feet deep at mean low water, and thence to the town of Weldon, which is 129 miles from the mouth, the minimum depth was 2½ feet at the same stage.

The approved project of 1871 contemplates a channel with a least width of 50 feet from Hamilton to Weldon, 5 feet deep at mean low water, and the removal in the lower portion of the river, below the former point, of such obstructions as may be necessary to accommodate vessels navigating the North Carolina sounds. The estimated cost of the work was \$269,000.

The expenditures to June 30, 1903, amounted to \$222,746.84, with which the channel obstructions were removed, and a channel depth of 4 feet at mean low water, over the projected width, provided between Hamilton and Weldon. On June 30, 1903, vessels drawing 10 feet could go as far as Hamilton, and beyond that point to Weldon 4 feet could be carried at mean low water. The upper river is subject to heavy freshets, which cause the only variation in the level of the water surface.

The commerce has varied considerably since the improvement was undertaken, the maximum amount of freight transported having been in 1891, when it was 376,181 tons. For the calendar year 1902 it amounted to 163,564 tons.

July 1, 1902, balance unexpended	\$10,605.77
June 30, 1903, amount expended during fiscal year	4,014.61
July 1, 1903, balance unexpended	6,591.16
July 1, 1903, outstanding liabilities	143.75
July 1, 1903, balance available	6,447.41
{ Amount (estimated) required for completion of existing project	41,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix M 11.)

12. *Removing sunken vessels or craft obstructing or endangering navigation.*—(a) *Wreck of raft in North River, North Carolina.*—A portion of a raft was abandoned in this stream near North River bar, and several complaints were made of its obstructing navigation. The removal of the logs composing a portion of the raft was authorized December 13, 1902, and the same was accomplished between January 12 and 16, 1903, at a cost of \$200.38. The obstruction consisted of 120 logs 16 to 30 feet long, which were taken out of the water and placed on the shore near Newbern Landing, North Carolina.

(b) *Wreck of schooner Marion A. Greene.*—This small schooner sunk in 12 feet of water about 4,500 feet south by east from Wade Point light in Albemarle Sound, North Carolina, and was abandoned. Its removal was authorized December 15, 1902, and was effected between January 5 and 10, 1903, at a cost of \$128.49.

(c) *Wreck of raft in Pasquotank River, North Carolina.*—Several cribs of logs from a raft were abandoned in the Pasquotank River, near Shipyard Landing, and, being an obstruction to navigation, their removal was authorized January 9, 1903. The work was performed between May 28 and June 3, 1903, at a cost of \$100.

(d) *Wreck of schooner Willie Lee Hall.*—The wreck of this small schooner was located off Newport News Point in Hampton Roads, Virginia, and its removal was authorized April 17, 1903. All but a portion of the bow of the wreck had been removed at the close of the fiscal year.

(See Appendix M 12.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN NORTH CAROLINA.

This district was in the charge of Capt. E. W. Van C. Lucas, Corps of Engineers, to November 3, 1902, and of Capt. E. Eveleth Winslow, Corps of Engineers, since that date. Division Engineers, Col. Peter C. Hains, Corps of Engineers (now brigadier-general, United States Army), to March 31, 1903, and Lieut. Col. James B. Quinn, Corps of Engineers, since that date.

1. *Scuppernon River, North Carolina.*—From the mouth to Columbia is 5 miles; to Spruills bridge, the head of navigation, 23 miles.

Prior to present improvement the channel across bar at mouth of river was very narrow and less than 6 feet in depth.

Prior to 1902, \$10,000 was expended under a project to provide a channel 9 feet deep and 60 feet wide up to Spruills bridge.

The project adopted by act of June 13, 1902, provides for dredging a channel 3,400 feet long, 9 feet deep, and 150 feet wide across the bar at mouth of river at a cost of \$14,000.

Amount expended on present project, for improvement, \$6,991.90.

There has been removed by dredging 32,751 cubic yards of material from a cut across the bar, 3,350 feet long, 90 feet wide, and 9 feet deep at mean low water.

The present condition is a channel 90 feet wide, with a least depth of 9 feet at mean low water across the bar at mouth of river; thence to Cross Landing, 14 miles above, is a good open channel of 7 feet at mean low water, free from obstacles; thence to Spruills bridge, 9 miles farther, only 7 feet at mean low water can be carried, the river in many places being narrow and crooked and obstructed by overhanging trees on banks and logs and snags in channel.

This is a nontidal stream, with no slope, the oscillations of the surface being controlled by the winds.

The commerce for 1902 amounted to 34,306 tons and consisted principally of cotton, lumber, etc.

The adopted plan is printed in the Annual Report of the Chief of Engineers for 1901, page 1543, and in House Document No. 131, Fifty-sixth Congress, second session.

July 1, 1902, balance unexpended	\$10,000.00
June 30, 1903, amount expended during fiscal year	6,991.90
July 1, 1903, balance unexpended	3,008.10
July 1, 1903, outstanding liabilities	1,065.66
July 1, 1903, balance available	1,942.44
{ Amount (estimated) required for completion of existing project	4,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.	3,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 1.)

2. *Ocracoke Inlet, North Carolina.*—The original condition was as follows: Between Pamlico Sound and the inlet was a fan-shaped shoal, over which were several channels, the best of which afforded a high-water depth (in 1830) of 5 feet. These shoals are constantly shifting, and the practicable depth varies, when left to natural causes, between

5 and 8 feet at high water. The channel over the ocean bar is much better and has probably for many years had an average low-water depth of about 12 feet.

The original project of 1827 was to obtain a channel through the inner shoals, 400 feet wide and 10 feet deep at high water. Dredging under this project began in 1830 and resulted in deepening to 8.5 feet for partial width, but the project was abandoned in 1837 after the destruction of a maintenance jetty and the shoaling of the dredged cut.

The project of 1889 was to dredge through the Wallace channel shoals a channel 300 feet wide and 10 to 15 feet deep at low water. In May, 1894, it was modified to dredge the Teachs Hole Swash route for a width of 400 feet and depth of 9 feet. July 9, 1894, it was again modified to dredge the Wallace channel route for a width of 300 feet and a depth of 9 feet. This project was completed in 1896.

There is no existing project, work of recent years having been restricted to occasional surveys to note channel changes.

Amount expended on project of 1827	\$133,732.40
Carried to surplus fund	17.60
	133,750.00
Amount expended on project of 1894	87,616.97
Amount expended on examination since 1896	8,909.50
	96,526.47

Since the completion of the 1894 project the dredged cuts have deteriorated and the conditions as shown by a recent survey are as follows:

There is a least depth at mean low water of 13.9 feet across the ocean bar, of 12.5 feet over the shoals just inside, and of 7.5 feet through Royal shoal cut. This latter is the present controlling depth of the channel at this inlet. There have been large changes since the survey of 1900 in the location and depths of the channel and shoals.

There has been practically no commerce passing in and out of the inlet since the opening of the Dismal Swamp Canal. The inlet is used principally by shallow-draft pleasure craft and tugs passing up and down the coast to avoid the dangers of Hatteras shoals.

References: House Document No. 64, Forty-eighth Congress, first session. Annual Reports, 1889, page 1118; 1891, page 1341; 1892, page 1115; 1893, page 1359; 1894, page 996; 1895, page 1306; 1896, page 1097; 1897, page 1386; and 1898, page 1237.

July 1, 1902, balance unexpended	\$8,473.53
Received from sales during fiscal year	15
July 1, 1903, balance unexpended	8,473.68
July 1, 1903, outstanding liabilities	327.94
July 1, 1903, balance available	8,145.74
(See Appendix N 2.)	

3. *Fishing Creek, North Carolina.*—Distance from the mouth to Beach Swamp, 17.5 miles; Coffield's bridge, 21.3 miles; Wilmington and Weldon Railroad bridge, 40 miles; Bellamy's mill, 44 miles.

When improvement began the stream was badly obstructed by masses of fallen timber and was navigable by rafts only a few miles above the mouth.

The original project of 1889 was to clear the stream up to Bellamy's mill of logs, snags, trees, etc. It was amended in 1896 to limit the work to that part below the Wilmington and Weldon Railroad bridge, and completed in 1901.

The existing project is to maintain the natural channel to Beach Swamp at an estimated annual cost of \$500.

Amount expended on previous project, mentioned above.....	\$22,715.50
Amount expended on present project, for maintenance	1,488.22
	24,193.72

Results: The stream has been cleared of obstructions to the Wilmington and Weldon Railroad bridge, but it is not navigable above Beach Swamp, the head of navigation, on account of its tortuous course and rapid current. Below that point it is navigable during the higher stages about eight months annually. It is not thought that the benefit to commerce on this stream is at all commensurate with expenditures for its improvement.

The commerce for 1902 amounted to 4,375 tons, a gain of 1,680 tons over last year, and consisted principally of cotton seed, timber, fertilizers, and peanuts. Additional work proposed is the maintenance of the natural channel as far as Beach Swamp.

References: Annual Reports for 1890, page 1179; 1893, page 1377; 1900, page 1796.

July 1, 1902, balance unexpended	\$2,034.50
June 30, 1903, amount expended during fiscal year	1,488.22
	546.28
July 1, 1903, balance unexpended	546.28
July 1, 1903, outstanding liabilities	23.40
	522.88

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 3.)

4. *Pamlico and Tar rivers, North Carolina.*—(One river called Pamlico below, and Tar above Washington, N. C.) Distance from Washington to Greenville, 22 miles; to Tarboro, 49 miles; Fishing Creek, 56 miles; Little Falls, 88 miles; Rocky Mount, 89 miles.

When improvement began the river was badly obstructed by war blockades, snags, logs, and fallen timber. The governing low water depths were 5 feet to Washington and perhaps 1 foot to Tarboro, navigation to which place was practicable during freshet stages only.

The original project of 1875, as extended in 1879 and 1889, constitutes the existing project, and includes obtaining 9 feet depth to Washington, 60 feet width with 3 feet depth to Greenville, and 20 inches depth to Tarboro, and a clear natural channel to Little Falls, at a cost estimated in 1891 at \$137,200.

Amount expended on previous project prior to 1876.....	\$10,000.00
Amount expended on present project:	
For improvement	105,677.50
For maintenance	17,184.59
	122,862.09

The shoal immediately above draw to wagon bridge at Washington was removed during the year by the dredging, with the United States plant, of 2,168 cubic yards of material, and snagging operations were carried on.

The channel has been deepened to 8 feet below Washington, and the project depth has been obtained to Greenville. The governing depths are 8 feet to Washington, 3 feet to Greenville, and about 15 inches to Fishing Creek. It is navigable during the freshet stages to Dunbar's bridge, the head of navigation, about 24 miles above Tarboro. Below Washington the only variations of importance are due to wind, with an extreme range of about 3 feet; above Washington the stream is subject to freshets, which rise to 15 feet or higher at Tarboro.

The commerce for 1902 amounted to 832,015½ tons, a loss of 103,296 tons since last year, and consisted principally of timber, lumber, fertilizers, cotton, and other farm products. It is proposed with the funds now available to complete the project below Washington, and to maintain the natural channel above that point.

A dredge is at present under construction to be paid for partly from funds pertaining to this stream, and to be used in obtaining and maintaining the project depths.

References: History and maps, Annual Reports, 1890, page 1114; 1891, page 1347; 1896, pages 161 and 1101.

Examinations and surveys: Annual Reports, 1873, page 555; 1879, page 700 (also H. Doc. No. 68, 45th Cong., 3d sess.); Annual Reports, 1891, page 1429 (also H. Doc. No. 289, 51st Cong., 2d sess.); Annual Report, 1895, page 1365 (also H. Doc. No. 62, 53d Cong., 3d sess.); Annual Report, 1897, page 1425 (also H. Doc. No. 5, 55th Cong., 1st sess.).

July 1, 1902, balance unexpended	\$35,585.04
Received from sales during fiscal year	49.55
	35,634.59
June 30, 1903, amount expended during fiscal year	4,947.13
July 1, 1903, balance unexpended	30,687.46
July 1, 1903, outstanding liabilities	598.31
July 1, 1903, balance available	30,089.15
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	3,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix N 4.)	

5. *Contentnia Creek, North Carolina.*—Distance from the mouth to Snowhill, 31½ miles; Speight's bridge, 50½ miles; Stantonsburg, 63 miles.

In its original condition the stream was badly obstructed with fallen timber, sand bars, and overhanging growth.

The original project of 1881 was to clear out obstructions and to obtain a depth of 3 feet to Stantonsburg during nine months annually, amended in 1894 to include maintenance below Snowhill. Operations since 1897 have been restricted to maintenance.

Amount expended on previous project:

For improvement	\$64,394.56
For maintenance	4,115.46

68,510.02

Amount expended on present project for maintenance 2,703.43

A clear channel has been maintained whenever funds were available, permitting navigation to Snowhill one-half to two-thirds of the year.

The stream is navigable at high stages only, the low-water depth being but a few inches. During the winter months the project depth usually exists. The stream is subject to freshets of 5 to 10 feet at Snowhill.

The head of navigation is Speight's bridge.

The commerce during 1902 amounted to 10,392 tons, a loss of 3,493 tons from that of 1900 (the last year for which statistics could be obtained), and consisted principally of timber, fertilizers, cotton, and general merchandise.

References: Annual Reports, 1899, page 1118; 1896, page 1103; 1881, page 1009 (also H. Doc. No. 85, 46th Cong., 3d sess.).

July 1, 1902, balance unexpended	\$38.17
Amount allotted from appropriation for emergencies in river and harbor works, act of June 6, 1900.....	500.00

538.17

June 30, 1903, amount expended during fiscal year 251.62

July 1, 1903, balance unexpended 288.55

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	1,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 5.)

6. *Neuse and Trent rivers, North Carolina.*—(a) *Neuse River.*—Distance from Newbern to Contentnia Creek, 32 miles; to Kinston, 50 miles; to Whitehall, 74 miles; to Goldsboro (Wilmington and Welton Railroad bridge), 94 miles; to Smithfield, 150 miles.

When improvement began the river was obstructed by war blockades and fallen timber, and the governing low-water depths were 8 feet to Newbern, 1½ feet to Kinston, and 1 foot to Smithfield.

The project of 1878, as extended in 1879 and 1880 and continued to date, is to clear the river of obstructions and obtain 8 feet depth to Newbern, 4 feet to Kinston, and 3 feet during nine months of the year to Smithfield; extended in 1902 to include dredging to 8 feet depth at dead low water for 300 feet width below Newbern and 200 feet width at Newbern, at an estimated cost of \$24,000.

Amount expended on present project, for improvement, \$303,857, and for maintenance, \$9,358.30, making a total of \$313,215.30.

All war blockades have been cleared away, and the natural channel has been cleared as far as Smithfield, the clearing being maintained generally as far as Goldsboro, the present head of navigation.

The projected depths do not exist above Newbern.

The present governing depths are 8 feet to Newbern at mean low water, 2.5 feet thence to the mouth of Contentnia Creek, and 1 foot thence to Kinston. Navigation farther than 25 miles above Newbern is practicable only during high stages. The water level at and below Newbern varies about 3 feet, depending on the direction of the wind.

Above Newbern the stream is subject to freshets, which, during the winter months, rise about 10 or 15 feet at Kinston.

Snagging operations were carried on during the year between Newbern and the 33-mile post, and a channel was dredged through the shoal at head of Ransom's channel, a short distance below wagon bridge at Newbern.

The present condition of the river from Newbern to Kinston is fairly good as regards the absence of channel obstructions; thence to Whitehall the river is very crooked and badly obstructed by fallen trees and logs dropped from rafts; from Whitehall to Goldsboro the obstructions are very numerous.

It is expected that report of the survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

The commerce during 1902 amounted to 456,994 tons, a gain over last year of 136,044 tons, and consisted principally of lumber, timber, general merchandise, fertilizers, cotton, and other farm products. It is proposed to maintain a channel above Newbern and to deepen to 8 feet at dead low water the channel at and below Newbern.

One transportation line was established during the year.

References: Annual Reports, 1879, page 708 (H. Doc. No. 68, 45th Cong., 3d sess.); 1891, page 1126, and 1897, page 1427 (H. Doc. No. 317, 54th Cong., 2d sess.).

(b) *Trent River, North Carolina*.—Distance from the mouth at Newbern to Pollocksville, 18 miles; to Lower Quaker Bridge, 27 miles; to Trenton, 38 miles. Its original condition was a channel of 6 feet depth to Pollocksville, and the stream was fairly clear to Lower Quaker Bridge, above which point it was badly obstructed.

The original project of 1879 was to secure 3 feet depth at low water to Trenton; extended in 1886 to obtain 8 feet depth through Foys flats; extended in 1889 to clear out obstructions to Upper Quaker Bridge, 40 miles above Trenton.

The existing project of 1896 is to maintain a channel 30 feet wide and 3 feet deep from Newbern to Trenton at an annual estimated cost of \$2,500, extended in 1902 to include dredging at Newbern to 8 feet depth at dead low water from harbor line to channel, at an estimated cost of \$24,000 additional.

Amount expended on previous project, mentioned above	\$64, 262. 64
Amount expended on present project, for maintenance	5, 948. 31

70, 210. 95

The improvement above Trenton has been abandoned; below Trenton a channel 30 feet wide and 3 feet deep at low water has been obtained and maintained. The present governing depth to Trenton is 3 feet. The retaining wall to the turning basin at Trenton, constructed of wood, is in bad condition and in need of repairs. There is also some dredging needed adjacent to the wall to restore the basin to its original dimensions.

Near the mouth the water level varies about 3 feet, according to the prevailing wind. At Trenton the stream is subject to freshets of about 3 to 5 feet during the winter months. The head of navigation is Trenton.

The commerce during 1902 amounted to 201,704 tons, an increase of 34,716.5 tons over the previous year, and consisted principally of lumber, general merchandise, fertilizers, cotton, and other farm products.

In addition to maintenance of present channel at Trenton, the work proposed is to make available the channel between the harbor line at Newbern and the deep river channel.

References: Annual Reports, 1879, page 711 (also H. Doc. No. 68, 45th Cong., 3d sess.); 1900, pages 268 and 1802; and 1901, page 1545 (also H. Doc. No. 121, 56th Cong., 2d sess.).

July 1, 1902, balance unexpended	\$20, 103. 49
Amount received from sales during fiscal year	97. 80

	20, 201. 29
June 30, 1903, amount expended during fiscal year	8, 029. 74

July 1, 1903, balance unexpended	12, 171. 55
July 1, 1903, outstanding liabilities	119. 84

July 1, 1903, balance available	12, 051. 71
---------------------------------------	-------------

{ Amount (estimated) required for completion of existing project	110, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 6.)

7. *Waterway between Newbern and Beaufort, N. C.*—(Via Neuse River, Clubfoot Creek, Clubfoot and Harlowe Canal (private), Harlowe Creek, and Newport River.) Distances: Newbern to Clubfoot Creek, 21 miles; thence to Clubfoot and Harlowe Canal, 5 miles; thence to Harlowe Creek, 2½ miles; thence to Newport River, 3¼ miles; thence to Beaufort, 7 miles. When improvement began in 1885 the governing low-water depth was 1 foot. The original project of 1884, as continued to date, is to obtain 5 feet depth and 30 feet width, at an estimated cost of \$92,000.

Amount expended on present project for improvement, \$28,700.

The governing depth in the approaches to the canal was increased to about 5 feet several years ago, but for lack of maintenance has shoaled to about 1½ feet. The depth in the canal is only about 2 feet, and it is obstructed by logs dropped from passing rafts. The water level varies at Harlowe Creek end, where there is a tidal range of about 1½ feet, and at the Clubfoot Creek end, where there is a variation of level of 1 to 2 feet, due to the wind.

The commerce for 1902 amounted to 66,974 tons, a gain over 1900 (the last year for which statistics were obtained) of 31,195 tons. It consists almost entirely of timber and lumber. No additional work is proposed until the private canal has been ceded or sold to the United States.

References: Annual Reports, 1884, page 1065; 1890, page 1130; 1896, page 1113.

July 1, 1902, balance unexpended	^a \$6, 303. 67
June 30, 1903, amount expended during fiscal year	3. 67

July 1, 1903, balance unexpended	6, 300. 00
--	------------

Amount (estimated) required for completion of existing project	57, 000. 00
--	-------------

(See Appendix N 7.)

^a Erroneously reported last year as \$6,303.69.

8. *Harbor at Beaufort, N. C.*—When improvement (begun in 1836) was resumed in 1881 the erosion at the throat of the inlet was causing serious deterioration of the inside channel and threatening deterioration of the bar channel. The governing low-water depths were 15 feet on the bar and 2 feet to Beaufort.

The original project of 1881 was to stop the erosion at the inlet by jetties at Fort Macon and Shackelford Point, and to dredge to 9 feet depth at low water and 200 feet width the channel from the Bulkhead channel to Beaufort, and to 6 feet depth and 100 feet width the channel from North River to Beaufort; modified in 1887 by postponing the dredging from North River and by reducing the proposed dimensions of Bulkhead channel to 5 feet depth and 100 feet width; modified in 1890 by increasing the proposed depth of the Bulkhead channel to 7 feet. As amended, this project is completed.

The existing project of 1896 includes the maintenance of jetties and sand fences at Fort Macon and Shackelford Point and the maintenance of channel across Bulkhead shoal to Beaufort Harbor.

Amount expended on previous project, mentioned above	\$148, 845. 32
Amount expended on present project for maintenance	7, 280. 11
	156, 125. 43

The erosion at the inlet has been stopped and the sand banks at Fort Macon and Shackelford Point have been built up and strengthened by means of sand fences. The 7-foot channel across Bulkhead shoal has deteriorated to a present low-water depth of about 4 feet. The governing low-water depths are 12 feet on the bar and 4 feet to Beaufort. The tidal range varies from about 3½ feet at the inlet to about 2 feet at Beaufort.

The commerce for 1902 amounted to 78,983 tons, an increase of 6,800 tons over last year, and consisted of oysters, fish, lumber, and farm products. It is proposed to maintain the sand fences at Fort Macon and Shackelford Point and to restore the project depth across Bulkhead shoal to Beaufort.

References: Annual Reports, 1881, page 1013 (also H. Doc. No. 78, 46th Cong., 3d sess.); 1893, page 1457 (also H. Doc. No. 246, 52d Cong., 2d sess.); 1896, page 1115; 1899, page 1498.

July 1, 1902, balance unexpended	\$3, 025. 26
Received from sales during fiscal year	350. 00
	3, 375. 26
June 30, 1903, amount expended during fiscal year	1, 150. 69
	2, 224. 57
July 1, 1903, balance unexpended	94. 60
July 1, 1903, outstanding liabilities	
	2, 129. 97

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	2, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 8.)

9. *Inland waterway between Beaufort Harbor and New River, North Carolina.*—Distance from Beaufort to Swansboro, 30 miles; to New River, 52 miles, with access at Swansboro to the Atlantic Ocean through Bogue Inlet.

When improvement began, in 1886, the governing low-water depth was 18 inches to Swansboro, and 6 inches thence to New River.

The project of 1885, as modified in 1896 and continued to date, is to obtain a channel 3 feet deep and 60 feet wide from Beaufort to Swansboro.

No project was adopted for the part beyond Swansboro, pending repeal of the act of the North Carolina legislature granting to private parties exclusive navigation privileges, which have now expired by limitation.

Amount expended on present project for improvement, \$42,670.32.

Since the adoption of the project the channel has been dredged to 3 feet depth and a width of from 40 to 100 feet, but has deteriorated for lack of maintenance, the governing low-water depth being about 2 feet. The tidal range at Beaufort and Bogue Inlet is about $3\frac{1}{2}$ feet, and decreases to a few inches in the middle of Bogue Sound.

The commerce for 1902 amounted to 18,608 tons, a loss over last year of 15,309 tons, and consisted principally of lumber, fish, and farm products.

It is proposed, with the funds now available, to complete the existing project, using a dredge now under construction by the United States.

References: Annual Reports, 1885, page 1133 (Senate Doc. No. 35, Forty-fourth Congress, first session); 1891, page 1378; 1892, page 1141; 1893, page 1397; 1894, page 1034; 1896, page 1117; 1897, page 1398.

July 1, 1902, balance unexpended	\$10, 449. 64
June 30, 1903, amount expended during fiscal year.....	119. 96
July 1, 1903, balance unexpended.....	10, 329. 68

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	1, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 9.)

10. *New River, North Carolina.*—The distance to Jacksonville, the head of navigation, 23 miles.

When improvement began, in 1886, the governing low-water depth was 4 feet, and the channel included two circuitous parts around Wrights Island and Cedar Bush Marsh.

The original project of 1886 was to dredge a cut 4 feet deep and 100 feet wide through Wrights Island and a second cut 4 feet deep and 150 feet wide through Cedar Bush Marsh. Both were completed, but the Cedar Bush Marsh cut deteriorated at the upper end and was abandoned, and the project of June 18, 1894, to obtain 4 feet depth around Cedar Bush Marsh by dredging and training wall was adopted and successfully carried out.

It is expected that report of the survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

There is no existing project, and no work has been done since the completion of the 1894 project.

Amount expended to June 30, 1903, for maintenance, \$29,766.81.

The project depth of 4 feet has been twice obtained, and twice lost through lack of maintenance; it now exists, but in a channel so crooked

as to be of little value. The tidal range at the inlet is about $3\frac{1}{4}$ feet and at the head of the marshes about 1 foot.

The commerce for 1902 amounted to 5,211 tons, an increase of 1,655 tons over the preceding year, and consisted principally of naval stores, fish, lumber, cotton, and general merchandise.

References: Annual Reports, 1882, page 1117; 1886, page 992; 1891, page 1380, and 1899, page 1501.

July 1, 1902, balance unexpended	\$3, 371. 26
Received from sales during fiscal year	. 10

	3, 371. 36
June 30, 1903, amount expended during fiscal year	138. 07

July 1, 1903, balance unexpended	3, 233. 29
--	------------

(See Appendix N 10.)

11. *Northeast and Black rivers, and Cape Fear River above Wilmington, N. C.*—(a) *Northeast River.*—Distance from mouth to Bannermans Bridge, 48 miles; to Hallsville, 88 miles; to Kornegays Bridge, the head of navigation, 103 miles.

The original condition when improvement began was a channel badly obstructed by logs, snags, and overhanging trees. The river was navigable to Bannermans Bridge, with governing low-water depth of 6 feet.

The original project of 1889 is still in force and includes the clearing of the natural channel for small steamers to Hallsville, and for pole boats to Kornegays Bridge, at an estimated cost of \$30,000.

Amount expended on previous project, mentioned above	\$10, 687. 96
Amount expended on present project, for maintenance	7, 606. 42

18, 294. 38

The result obtained has been a cleared channel whenever funds were available, permitting navigation at all stages to Bannermans Bridge and during high water to Hallsville, the governing low-water depth being 6 feet to Bannermans Bridge. From Bannermans Bridge to Kornegays Bridge the river is so shallow that its navigation is dependent on freshets. It is navigable for small boats for about eight months annually. There is a tidal range of about 2 feet at the mouth, which gradually decreases to nothing at Bannermans Bridge. Freshets are liable to occur at any time, although during the summer low-water stages usually prevail.

The commerce for 1902 amounted to 100,186 tons, an increase of 33,313 tons over 1901, and consisted principally of timber, naval stores, general merchandise, building material, fertilizers, cotton, and other farm products. Additional work proposed is for maintenance only.

References: Annual Reports, 1885, page 1123; 1890, page 1181; 1895, page 1389, and 1896, page 1122; (also House Ex. Doc. No. 35, Fifty-first Congress, first session, and No. 322, Fifty-third Congress, third session).

(b) *Black River.*—Distance from mouth to Point Caswell, 24 miles; Haws Narrows, 34 miles; Clear Run, 64 miles; Lisbon, the head of navigation, 86 miles.

The original condition when improvement began was a natural channel cleared fairly to Point Caswell and roughly to Lisbon, with governing low-water depths of 4 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Lisbon.

The original project of 1885 included clearing the natural channel and banks to Lisbon and the cutting off of a few sharp points at bends; it was amended in May, 1893, by omitting that part of the river above Clear Run, and as amended was completed September 20, 1895.

The existing project of 1894 is to maintain the natural channel to Clear Run, at an estimated cost of \$2,000 per annum.

Amount expended on previous project, mentioned above	\$12,358.40
Amount expended on present project, for maintenance	6,931.98
	19,290.38

The result obtained has been a cleared channel whenever funds were available, permitting navigation to Point Caswell at all stages and to Clear Run at stages of 1.5 feet or higher above low water, the governing low-water depths being 5 feet to Point Caswell, 2.5 feet to Haws Narrows, and 1.5 feet to Clear Run. The low-water stages prevail usually from May to August, inclusive; during the rest of the year the stage is about 5 to 8 feet higher.

The commerce during 1902 amounted to 72,224 tons, an increase of 11,155 tons over 1901, and consisted principally of timber, general merchandise, naval stores, fertilizers, cotton, and other farm products. No further work excepting maintenance is now proposed.

References: For history see Annual Report for 1896, page 1125. For reports on examination, see Annual Report for 1884, page 1061, and 1885, page 1145.

(c) *Cape Fear River above Wilmington.*—Distance from Wilmington to Kellys Cove, 47 miles; Elizabethtown, 73 miles; Fayetteville, the head of navigation, 115 miles.

The original condition when work began was a channel badly obstructed above Kellys Cove by logs, snags, etc., and with governing low-water depths of 4 feet to Kellys Cove and 1 foot to Fayetteville.

The original project of January 26, 1881, was to clear the river to Fayetteville and obtain a continuous channel by jettying and dredging; estimated in July, 1893, to cost \$275,000 for a channel 4 feet deep to Elizabethtown and 3 feet deep to Fayetteville.

The existing project, adopted by act of June 13, 1902, is to obtain by canalization a low-water depth of 8 feet to Fayetteville, at an estimated cost of \$1,350,000.

Amount expended on previous project, for improvement	\$134,439.96
Amount expended on previous project, for maintenance	11,278.75

Total	145,718.71
Amount expended on present project, for improvement by locks and dams	352.23

The results obtained have been a cleared channel to Fayetteville, when funds were available, and increased depths above Kellys Cove to 2.5 feet to Elizabethtown and 2 feet to Fayetteville. The tidal range at Wilmington is 2.5 feet, which gradually decreases to nothing at Kellys Cove. Low-water stages prevail from two to four months during each summer, and freshets of 15 feet or higher occur about once a month during the remainder of the year.

The commerce for 1902 amounted to 167,534 tons, a gain of 43,422 tons over the preceding year, and consisted principally of timber, naval stores, fertilizers, general merchandise, cotton, and other farm products.

The sum of \$50,000 was appropriated by the act of June 13, 1902,

for the purchase of suitable sites for locks and dams. The survey for the determination of the sites has not yet been made.

References: Annual Reports for 1872, page 742; 1881, page 1018, and 1901, page 1559 (also House Doc. No. 180, Fifty-sixth Congress, second session.)

NORTHEAST AND BLACK RIVERS AND CAPE FEAR RIVER ABOVE WILMINGTON.

July 1, 1902, balance unexpended	\$10,340.65
June 30, 1903, amount expended during fiscal year	5,493.12
July 1, 1903, balance unexpended	4,847.53
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	6,000.00

CAPE FEAR RIVER ABOVE WILMINGTON.

July 1, 1902, balance unexpended	\$50,000.00
June 30, 1903, amount expended during fiscal year	352.23
July 1, 1903, balance unexpended	49,647.77
{ Amount (estimated) required for completion of existing project	
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	
	200,000.00

(See Appendix N 11.)

12. *Cape Fear River at and below Wilmington, N. C.*—In its original condition the governing high-water depth inside the bar was 10 feet, the bar depths at low water being 7.5 feet at the mouth and 8 feet at New Inlet, increased at high water to 12 and 12.5 feet, respectively.

The original project of 1827 was to deepen by jetties the channel through the shoals in the 8 miles next below Wilmington. This project resulted in a gain of 2 feet available depth. The project of 1853 was to straighten and deepen the bar channel by dredging, jettying, diverting flow from the New Inlet, and closing breaches in Zekes Island. This project was incomplete when the civil war began.

After the civil war the first project was that of 1870, to deepen the bar channel by closing breaches between Smiths and Zekes islands, with the ultimate closure of New Inlet in view. The project of 1873 included that of 1870, and, in addition, the dredging of the bar channel and the closing of New Inlet. The project of 1874 was to obtain by dredging a channel 100 feet wide and 12 feet deep at low water up to Wilmington. The project of 1881 was to obtain, by dredging, a channel 270 feet wide and 16 feet deep at low water up to Wilmington. These projects had been practically completed in 1889.

The existing project of October 6, 1890, is to obtain a low-water depth of 20 feet and a width of 270 feet from Wilmington to the ocean, at an estimated cost of \$1,800,000. This project was modified by act of June 13, 1902, to include the construction of mooring dolphins at Wilmington, at a cost of \$30,000, and removal of obstructions at mouth of Brunswick River, at an estimated cost of \$1,000.

Expenditures.

Prior to civil war.....	\$363, 228. 92
Since civil war, on previous projects.....	2, 101, 271. 93
	<u>2, 464, 500. 85</u>

On existing project to June 30, 1903:

For improvement	864, 621. 77
For maintenance	125, 893. 12
	<u>990, 514. 89</u>

In general the river channel has been dredged to a least width of 148 feet and least low-water depth of 19 feet, with tidal rise of 4 feet, but subsequent shoaling has decreased the governing depth to 18 feet at low water and 21 feet at high water. The tidal range varies from 4.5 feet at the bar to 2.5 feet at Wilmington.

The Old Woodbury jetty has been removed to a depth of 17 feet at mean low water. The easterly movement of the channel in the vicinity of this jetty is not so marked as it has been for the past few years.

At Ocean bar a channel of 20 feet depth at mean low water, with a least width of 300 feet exists from deep water inside to deep water outside.

On the shoals in the river between the bar and Wilmington the condition at mean low water is as follows:

Name of shoal.	Distance below Wilmington.	Length.	Width.	Depth.
	<i>Miles.</i>	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>
Wilmington.....	0	3, 200	270	20
Alligator Creek.....	1½	9, 800	148	20
Brunswick River.....	3	8, 600	185 to 222	20
Logs and Big Island.....	7	16, 700	148	20
Keg Island.....	9½	4, 000	148	19 to 20
Lilliput.....	11	17, 200	148	18½ to 20
Old Brunswick Cove.....	13½	5, 000	148	18½ to 20
Midnight.....	16	14, 000	148	18½ to 20
Reaves Point.....	19	2, 000	148	18½ to 20
Snows Marsh.....	20	9, 600	175	18
Ocean bar.....	30	6, 000	300	20

The pile and brush portion of Snows Marsh dike is entirely destroyed and the solid pile portion almost obliterated. New Inlet and Swash Defence dams are in about the same damaged condition as at the first of the year, the only work done to them being the placing of the stone removed from the Old Woodbury jetty in the worst breaks. The sea beaches remain in practically the same condition as at the beginning of the year.

The commerce for 1902 amounted to 841,631 tons, an increase of 114,272 tons over the preceding year, and consisted principally of cotton, naval stores, manufactured lumber and shingles, fertilizers, building material, coal, and general merchandise. The estimated value was \$44,055,000 and it is the largest recorded. The increase from 220,000 tons in 1869 is due to the improvement of the river. The additional work proposed is the completion of the existing project, but the entire appropriation of June 13, 1902, will probably be needed to restore the conditions of three years ago.

For special descriptions see Annual Reports of the Chief of Engineers for 1873, page 44; 1887, page 1047; 1895, page 1335; 1896, page

1131; and 1901, page 1552 (also House Doc. No. 180, Fifty-sixth Congress, second session).

July 1, 1902, balance unexpended	\$162,137.31
Received from sales during fiscal year	277.40

	162,414.71
June 30, 1903, amount expended during fiscal year	68,332.60

July 1, 1903, balance unexpended	94,082.11
July 1, 1903, outstanding liabilities	8,148.98

July 1, 1903, balance available	85,933.13
July 1, 1903, amount covered by uncompleted contracts	2,150.00

(Amount (estimated) required for completion of existing project	885,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	150,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix N 12.)

13. *Town Creek, Brunswick County, N. C.*—Distance from mouth to Russels Landing (upper bridge), 20 miles; to Rocks Landing, 23 miles.

In its original condition this stream was badly obstructed by logs, snags, and overhanging trees, and by a shoal just below Russels Landing on which the governing depth was 1.5 feet.

The original project of 1881 was to obtain a 4-foot channel at low water by dredging and clearing along 20 miles from the mouth, at an estimated cost of \$9,078. After expending \$1,000 this project was abandoned for lack of appropriations. A second project of 1899 was to clear the stream of obstructions to Rocks Landing and to obtain a channel depth of 5 feet at low water with 40 feet width to Russels Landing, at an estimated cost of \$8,500. This project was completed in 1901.

Amount expended on previous project, mentioned above	\$1,000.00
Amount expended on present project of 1899, for improvement	8,402.45
Amount expended on present project of 1899, for maintenance	97.55

9,500.00

This stream has been cleared to Rocks Landing, and the channel to Russels Landing deepened to 5 feet at low water for 40 feet width, and remains in good condition. The tidal range varies from 3 feet at the mouth to a few inches at Russels Landing. The upper part is subject to freshets of 1 or 2 feet rise.

The head of navigation is Rocks Landing.

It is not thought that the benefits to commerce on this stream are sufficient to justify further expenditures for its improvement.

The commerce for 1902 amounted to 13,384 tons, a gain of 3,521 tons over last year, and consisted of general merchandise, naval stores, lumber, fertilizers, cotton, rice, and other farm products.

No transportation lines were established during the year.

References: Annual Reports, 1881, page 1024 (also House Doc. No. 78, Forty-sixth Congress, third session); 1897, page 1434 (also House Doc. No. 214, Fifty-fourth Congress, second session); 1900, page 1927.

July 1, 1902, balance unexpended	\$97.55
June 30, 1903, amount expended during fiscal year	97.55

(See Appendix N 13.)

IMPROVEMENT OF WACCAMAW RIVER, NORTH CAROLINA AND SOUTH CAROLINA, AND OF CERTAIN RIVERS AND HARBORS IN SOUTH CAROLINA.

This district was in the charge of Capt. J. C. Sanford, Corps of Engineers, to April 28, 1903, and of Capt. G. P. Howell, Corps of Engineers, since that date. Division Engineers, Col. Peter C. Hains, Corps of Engineers (now brigadier-general, United States Army), to March 31, 1903, and Lieut. Col. James B. Quinn, Corps of Engineers, since that date.

1. *Waccamaw River, North Carolina and South Carolina, and Little Pedee River, South Carolina.*—(a) *Waccamaw River.*—In 1880 this stream was navigable for 12-foot boats at all stages of water from Georgetown, 23 miles, to Bull Creek, and at high water 4 miles farther, to Bucks lower mills; thence for 7-foot-draft boats, at high water, 22 miles farther, to Conway; thence it possessed an obstructed channel for 3-foot-draft boats, at ordinary winter water, 68 miles, to Reeves Ferry; thence an obstructed channel, with 3 feet at high water, for 30 miles, to Lake Waccamaw.

The project of improvement, adopted in 1880, provides for a channel 12 feet deep at all stages of water, with 80 feet bottom width from the mouth of the river to Conway, thence a cleared channel to Lake Waccamaw.

The original estimated cost was \$29,370, which was revised in 1885 and increased in the annual report of that year to the present figure, \$138,400. In the Annual Report of the Chief of Engineers for 1886, page 170, maintenance is estimated at \$4,000 per year after completion of improvement.

The total expenditure to June 30, 1903, was \$104,422.45. The river had been cleared of snags to a distance of 128 miles above the mouth, and this portion of the river had been frequently resnagged as appropriations permitted, 38,220 snags, etc., having been removed since June 30, 1884. Some work had been done toward increasing the original depth on eight shoals below Conway. As nearly as could be determined from the records, about \$75,977.81 had been expended in originally snagging the lower 128 miles of the river and in constructing pile and plank dikes at eight shoals, and \$28,444.64 in maintenance.

The available depths reported as now existing do not differ greatly from the original depths. At mean low water about 11 feet can be carried to Bucksville, 34 miles above the mouth; about 6 feet to Toddsville, 38½ miles; about 4 feet to Conway, 50 miles; about 2 feet to Wortham's bridge, 97 miles. At high water large side-wheelers can go to Red Bluff, 74 miles, and small boats to Reeves Ferry, 117 miles. The usual variation in water level is about 7.5 feet at Conway, 50 miles above the mouth, and about 12 feet at Star Bluff, 84 miles above the mouth.

The tidal influence at low water extends 97 miles above the mouth.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1887.....		\$2, 129, 231.75	1896.....	203, 388	\$2, 314, 175.00
1889.....		2, 308, 915.00	1897.....	241, 300	2, 406, 390.00
1890.....	67, 196	2, 317, 368.50	1898.....	258, 191	2, 666, 280.00
1891.....	76, 245	2, 231, 112.00	1899.....	376, 822	3, 135, 214.00
1892.....	83, 103	2, 178, 369.00	1900.....	467, 887	3, 481, 072.00
1893.....	70, 976	2, 095, 548.00	1901.....	302, 655	3, 835, 700.00
1894.....	99, 298	2, 120, 864.00	1902.....	141, 686	1, 844, 019.00
1895.....	128, 466	2, 063, 697.00			

In previous reports the commerce on the Great Pedee River has been included, as it is carried over the lower 22 miles of the Waccamaw River to get to Georgetown, but for the year 1902 it has been omitted. If the commerce on both streams be added together it will amount to a tonnage of 293,694, with a value of \$3,172,989.

The vessels engaged in traffic on this river are steamers and tug-boats of from 10 to 550 tons, seagoing schooners of from 300 to 500 tons, pole boats, rafts, etc. The additional work proposed is necessary to make the improvement available. No new line of transportation was established during the year.

For outline map of the river see page 1200, Annual Report of the Chief of Engineers for 1889. For report on preliminary examination see page 848, Annual Report of the Chief of Engineers for 1880. (Printed as Senate Ex. Doc. No. 117, 46th Cong., 2d sess.)

It is expected that report of the survey authorized by the river and harbor act, approved June 13, 1902, will be submitted to Congress in December, 1903.

(b) *Little Pedee River*.—The river in its original condition was much obstructed by snags and overhanging trees and by 10 bridges without draws. In places it was divided into several branches, in none of which was there a good channel.

Under the plan of improvement adopted in 1888 it is proposed to snag the river and close unnecessary branches, providing for steam-boat navigation up to the mouth of Lumber River, 65 miles, and for pole-boat navigation 48 miles farther, to Little Rock, at an estimated cost of \$50,000.

The total expenditures to June 30, 1903, were \$22,052.08. No work had been done on the river since June 30, 1898. The river had been well snagged up to the mouth of Lumber River and roughly cleared for pole-boat navigation to Little Rock. No work had been done toward increasing the original depths. As nearly as could be determined from the records, about \$19,549.99 had been expended in originally snagging the river and about \$2,502.09 in maintenance.

The available depths now existing do not probably differ greatly from the original depths. The usual variation in water level at Gilchrist bridge, about 65.5 miles above the mouth, is about 9.5 feet.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	4,614	\$52,760	1897.....	13,162	\$100,400
1892.....	7,115	92,964	1898.....	11,900	105,750
1893.....	6,153	101,535	1899.....	16,685	144,787
1894.....	8,375	114,600	1900.....	23,780	173,500
1895.....	12,438	117,470	1901.....	51,460	399,000
1896.....	17,050	198,500	1902.....	57,050	416,000

The vessel using the river is 1 steamer of 89 tons, which runs to Gallivant's bridge, 47 miles above its mouth. No new line of transportation was established during the year.

The additional work proposed is necessary to make the improvement available.

For outline map of river see page 1214, Annual Report of the Chief of Engineers for 1890. For preliminary examination and survey see page 1111, Annual Report of the Chief of Engineers for 1887.

July 1, 1902, balance unexpended	\$10, 816. 80
June 30, 1903, amount expended during fiscal year	1, 891. 33
July 1, 1903, balance unexpended	8, 925. 47
July 1, 1903, outstanding liabilities	1, 313. 53
July 1, 1903, balance available	7, 611. 94
{ Amount (estimated) required for completion of existing project	53, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix O 1.)	

2. *Great Pedee River, South Carolina.*—The river in its original condition was dangerously obstructed by logs everywhere. Boats drawing 9 feet of water were able to reach Smith Mills, 52 miles above the mouth. Those drawing $3\frac{1}{2}$ feet could get 54 miles farther up at low water, to Little Bluff, or at high water to Cheraw, 172 miles from the mouth.

The project of improvement adopted in 1880 provides for a thoroughly cleared 9-foot navigation to Smith Mills and a $3\frac{1}{2}$ -foot navigation to Cheraw at all stages of water.

The original project contained no estimate of cost. From 1880 to 1886, inclusive, \$47,000 was appropriated. In the Annual Report of Chief of Engineers for 1886, page 170, it was estimated that \$70,000 in addition to this \$47,000 would complete the improvement, and that \$5,000 a year would be required for maintenance.

A project for the improvement of the upper river (the 64 miles between Cheraw and the bridge of the Wilmington, Columbia and Augusta Railroad) was adopted in 1902. (See Annual Report of the Chief of Engineers for 1901, p. 1607.) This project provides for obtaining, by snagging and dredging, a cleared channel, with a least depth of $3\frac{1}{2}$ feet at mean low water, at a cost of \$118,300; and the work was placed in the continuing-contract class. A total of \$52,000 has been appropriated, but no work has yet been done.

The total expenditures to June 30, 1903, were \$113,453.56. The river had been well cleared of snags from the mouth to the Wilmington, Columbia and Augusta Railroad bridge, 108 miles, and less thoroughly snagged between the bridge and Cheraw, 35,161 snags, etc., having been removed since June 30, 1884. No work had been done toward increasing original depths.

As nearly as could be determined by the records, about \$78,919.13 had been expended in originally clearing the river of snags and in preliminary examination and survey made in 1900, and about \$34,534.43 in maintenance.

The present available depths are believed to be not far different from those originally existing, though there are a large number of shoals above the bridge on which the depth at low water is less than $3\frac{1}{2}$ feet.

At mean low water 8 feet can be carried to Smith Mills, 52 miles above the mouth; about 3 feet to the Wilmington, Columbia and Augusta Railroad bridge, 108 miles above; and about 2 feet to Cheraw, the head of navigation, 172 miles above.

The usual variation in water level is 16.4 feet at Smith Mills and 34.2 feet at Cheraw.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	62,344	\$1,367,330	1897.....	114,177	\$1,167,914
1892.....	92,471	1,401,038	1898.....	75,280	1,228,885
1893.....	94,661	1,166,874	1899.....	134,072	1,692,709
1894.....	91,025	1,169,070	1900.....	154,727	2,645,560
1895.....	106,115	893,430	1901.....	188,912	2,811,080
1896.....	229,964	1,825,250	1902.....	182,006	1,328,970

The vessels engaged in traffic on this river are steamers of 400 tons and less, seagoing schooners, pole boats, rafts, etc. No new line of transportation has been established during the past year.

The additional work proposed is necessary to make the improvement available and for the extension of the benefits.

For preliminary examination and survey see page 845, Annual Report of the Chief of Engineers for 1880 (printed as S. Ex. Doc. No. 117, 46th Cong., 2d sess.). For outline map of river see page 1180, Annual Report for 1889. For preliminary examination and survey of 1900 see page 1607, Annual Report of the Chief of Engineers for 1901 (printed in H. Doc. No. 124, 56th Cong., 2d sess.).

July 1, 1902, balance unexpended.....	\$22,804.82
Amount appropriated by sundry civil act approved March 3, 1903.....	40,000.00
	62,804.82
June 30, 1903, amount expended during fiscal year.....	2,258.38
	July 1, 1903, balance unexpended..... 60,546.44
July 1, 1903, outstanding liabilities.....	500.31
	July 1, 1903, balance available..... 60,046.13
{ Amount (estimated) required for completion of existing project.....	66,300.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement.....	\$40,000.00
For maintenance of improvement.....	3,000.00
	43,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix O 2.)	

3. *Winyah Bay, South Carolina.*—This large bay is connected with the ocean by a passage between the shores of North and South islands $2\frac{1}{2}$ miles long, 1 mile wide at the bay, three-fourths mile wide at the gorge, and $1\frac{1}{4}$ miles wide at the ocean or southeasterly end of North Island. Through the passage, which trends north-northwest and south-southeast, there was a bold channel 36 feet deep at the bay, retaining a depth of not less than 20 feet until about 3,000 feet southerly from the end of North Island and of not less than 15 feet to a point about 1 mile south of the island, where the channel divided into two. One of these two channels, known as Main channel, continued $3\frac{1}{4}$ miles farther, through extensive shoals, to the 18-foot contour in the ocean. This channel was south-southeast and in alignment with the main channel through the straits. The other, known as Bottle channel, after flowing about 2,500 feet southeasterly, 1,500 feet easterly, and about 3,000 feet northeasterly, reached the 18-foot contour in the ocean at a distance of about $1\frac{1}{4}$ miles in a direction from the point of separation from the main ship channel almost at right angles with the direction of

that channel and of the channel through the passage. At mean low water the depth on the crest of the bar was variable in both channels and about 7 to 9 feet in the Main channel and 6 to 8 feet in Bottle channel. The mean range of tide is $3\frac{1}{4}$ feet.

The present project, adopted in 1889, provides for the construction of two jetties, springing, respectively, from North and South islands and converging toward the bar, the jetties to consist of mattress foundation and a superstructure of large riprap stone raised to a height of 6 feet above mean low water, the south jetty to extend due east across the bar and the north jetty to converge toward it, so as to produce the necessary contraction on the bar. The depth to be secured is 15 feet at mean low water. The river and harbor act approved June 3, 1896, authorized the completion of the work under continuing-contract system, at a cost not exceeding \$1,996,250, in addition to the \$20,000 appropriated by the act. A total of \$1,778,500 has been appropriated by sundry civil acts since that date. The project was extended by the river and harbor act approved June 13, 1902, to permit dredging at the shoal places in Winyah Bay, between the entrance and the city of Georgetown, S. C., over which the least channel depths might at any time be less than at the entrance to the bay, provided that the expenses of this dredging added to that of improving the entrance to the bay should not exceed the total amount authorized under the continuing-contract system.

The total expenditures to June 30, 1903, were \$1,994,010.30, of which \$428,750 was appropriated prior to June 3, 1896. The following work has been done: The north jetty, extending a distance of 11,139 feet from the shore end, has been completed with crest from $4\frac{1}{2}$ to 6 feet above mean low water; a small mound has been built where the jetty changed direction. On the south jetty the foundation mattress, extending to a point 21,051 feet from the shore end, was completed; the stone superstructure, built with practically no top width, has been carried to the proposed outer end; at this end a mound of large stone, with crest about 12 feet above mean low water, has been built; a number of mattresses have been sunk along the northern side of the jetty to prevent undermining, and the crest of the jetty near its shore end has been raised to about 10 feet above mean low water for a length of 1,240 feet. The seagoing suction dredge *Winyah Bay* has been built, and this dredge and the similar dredge *Charleston* have removed 1,105,583 cubic yards of material from the entrance channel and a shoal just within the bay. Spur dikes have been built to protect the South Island beach, and a mud dike to serve as a root for the south jetty. The jetty work, which since June 30, 1896, had been done under a continuing contract, has been completed.

The controlling entrance depth has been increased to 15 feet at mean low water. The channel over the Middle Ground shoal is still narrow, being reduced in two places to about 150 feet.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	261,370	\$8,071,600	1898.....	125,008	\$5,587,880
1892.....	271,986	.....	1899.....	120,567	6,337,853
1893.....	268,640	.....	1900.....	129,639	6,749,433
1894.....	293,822	.....	1901.....	247,989	8,467,906
1896.....	171,059	6,228,350	1902.....	387,471	9,310,682
1897.....	149,374	5,817,950			

The vessels using the entrance channel are steamers of 1,850 tons and less, and sailing vessels of various kinds. The freight carried is principally lumber, naval stores, and general merchandise. There are two lines of steamships plying between Georgetown and northern ports. The number of large steamships over 1,200 tons using the channel has been increased during the year from six to nine.

For preliminary examination and survey see Annual Report for 1885, page 1154. For report of Board of Engineers see Annual Report of the Chief of Engineers for 1889, page 1114 (printed as House Ex. Doc. No. 117, Fiftieth Congress, second session). For reasons for construction of mud dike, see Annual Report of the Chief of Engineers for 1895, page 1351.

July 1, 1902, balance unexpended	\$392, 077. 44
Amount appropriated by sundry civil act approved March 3, 1903.....	100, 000. 00
	492, 077. 44
June 30, 1903, amount expended during fiscal year	258, 803. 98
	233, 273. 46
July 1, 1903, balance unexpended.....	233, 273. 46
July 1, 1903, outstanding liabilities	2, 797. 41
	230, 476. 05
July 1, 1903, balance available.....	230, 476. 05
{ Amount (estimated) required for completion of existing project	217, 750. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement.....	\$120, 000. 00
For maintenance of improvement.....	40, 000. 00
	160, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix O 3.)	

4. *Santee, Wateree, and Congaree rivers, South Carolina.*—(a) *Santee River.*—This river in its original condition was considerably obstructed at all stages of water by sunken logs and snags. Its bar entrance was narrow, crooked, and shifting, with only about 4 feet of water at low tide, and so situated as to be difficult and expensive to improve.

The original project, adopted in 1880, contemplated providing an outlet for the river into Winyah Bay by constructing a canal from the river through Mosquito Creek into the bay. On this project there was expended \$99,750.

The present project, adopted in 1889, contemplates providing a more satisfactory outlet into the bay by cutting a canal 70 feet wide and 6 feet deep at mean low water from the Estherville plantation to Minim Creek and for snagging the entire river. The estimated cost is \$350,000, not including the amount expended under the original project.

The total expenditures under the present project to June 30, 1903, were \$172,185.32, of which about \$16,899.40 was for maintenance. The first cut of the canal had been made entirely through, and this had been widened through a portion of its length. From the Santee River proper 1,025 obstructions had been removed.

Except at the Winyah Bay end, where on account of the softness of the banks the width has been reduced to 40 feet and the depth to 4 feet, the canal is nowhere less than 50 feet wide and 5 feet deep. The mean rise of tide at the canal is about 3½ feet. The least available depth in Santee River is about 4 feet at low water. The usual variation in water level at the Atlantic Coast Line bridge, about 54½ miles

above the mouth, is about 19 feet. The river is navigable its entire length.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	100,255	\$2,743,000	1897.....	134,206	\$2,159,940
1892.....	110,523	2,775,800	1898.....	112,205	2,203,800
1893.....	124,182	2,679,600	1899.....	154,327	2,679,100
1894.....	115,428	2,375,000	1900.....	179,090	2,622,200
1895.....	117,690	2,224,800	1901.....	204,375	1,809,000
1896.....	134,135	2,204,600	1902.....	215,600	1,882,500

The vessels using the river and canal are steamers of from 10 to 500 tons, small sailing craft, pole boats, rafts, etc. No new line of transportation has been established during the past year. A steamer of 200 tons is now being built to run on this river and the Congaree River as far as Columbia.

The additional work proposed is necessary to make the improvement available and for extending the benefits.

For report on preliminary examination see page 916, Annual Report of the Chief of Engineers for 1880 (printed as Senate Ex. Doc. No. 161, Forty-sixth Congress, second session).

For full history of work see page 1036, Annual Report for 1886. For new project and map of river see pages 1184 and 1186, Annual Report for 1889. For statement showing comparative cost of dredging by contract and by hired labor see pages 1171 and 1172, Annual Report for 1896, and page 1459, Annual Report for 1897. For miscellaneous expenses see pages 1458 and 1459, Annual Report for 1897.

(b) *Wateree River*.—In its original condition this stream had a low-water depth of from 3 to 4 feet from its mouth, 67 miles, to Camden. The lower 14 miles was completely blocked at all stages of water by logs, snags, etc., and at moderate stages by the bridges of the South Carolina and the Wilmington, Columbia and Augusta railroads, then without drawspans; thence to Camden navigation was possible, but dangerous except during high water. Its commerce was practically nothing.

The present project of improvement, adopted in 1881, provides for safe and unobstructed 4-foot navigation for steamers from Camden to the mouth, at an estimated cost of \$60,000.

The appropriation of September 19, 1890, completed the estimate for the project, but four appropriations have since been made for maintenance. The work is one of snagging only, and as snags are continually lodging it is not susceptible of completion. Snagging work should be done annually in order to keep the channel open.

The river and harbor act approved June 13, 1902, provided for a preliminary examination of the Wateree River, with the proviso that "until further action by Congress improvement on said river is suspended." Report of the examination will be submitted to Congress in December, 1903.

The total expenditures to June 30, 1903, were \$72,309.25. To June 30, 1900, the river had been kept fairly clear of obstructions from the mouth to Camden. Since June 30, 1884, 24,912 obstructions had been removed, the records prior to that date not giving number removed.

So far as known the available depths now existing do not differ greatly from the original depths. The usual variation in water level

is about 17 feet at a point about 1 mile above the mouth and about 28.5 feet at Camden.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	1,005	\$51,210	1897.....	43,770	\$202,800
1892.....	2,244	86,040	1898.....	83,568	274,050
1893.....	6,242	117,729	1899.....	109,170	272,200
1894.....	18,075	94,334	1900.....	93,024	155,000
1895.....	21,697	127,565	1901.....	10,417	50,000
1896.....	35,002	233,525	1902.....	42,575	92,500

Rafting is the only business done on the river.

The additional work proposed is necessary to make the improvement available.

For report on preliminary examination see page 914, Annual Report of the Chief of Engineers for 1880 (printed as Senate Ex. Doc. No. 161, Forty-sixth Congress, second session). For survey report and project for improvement see page 1034, Annual Report of the Chief of Engineers for 1881 (printed as House Ex. Doc. No. 61, Forty-sixth Congress, third session). For outline map of river see page 1190, Annual Report of the Chief of Engineers for 1889.

(c) *Congaree River (open-channel work).*—In 1886 this stream in its original condition had a low-water depth of 3 to 4 feet from its mouth to the railroad bridge at Columbia, thence 1 foot low-water depth 2 miles farther to its head. The navigation of the lower 47 miles was blocked at all stages of water by the South Carolina Railroad bridge and by sunken logs, snags, and overhanging trees. The navigation of the remaining 2 miles was prevented by swift currents and numerous rock ledges and boulders. Its commerce was nothing.

The project of improvement, adopted in 1886, proposes to secure a thoroughly cleared 4-foot navigation over the lower 47 miles at all stages of water and a cleared channel 100 feet wide through the ledges and boulders above, at an estimated cost of \$54,500.

The total expenditures to June 30, 1903, were \$32,524.37. The channel had been thoroughly snagged from the mouth to Granby, 2 miles below Columbia. A total of 9,393 obstructions had been removed below Granby. As nearly as can be determined from the records, about \$19,523.82 had been expended in originally snagging the river and about \$13,000.55 in maintenance.

So far as known the available depths now existing do not differ greatly from the original depths.

About 4 feet can be carried at mean low water to Granby, the present head of navigation. The usual variation in water level at a point 2 miles above the mouth is about 24.3 feet and at Columbia about 33.2 feet.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	2,401	\$47,840	1897.....	40,857	\$110,100
1892.....	3,686	62,025	1898.....	81,362	201,700
1893.....	2,781	71,125	1899.....	88,696	191,700
1894.....	7,974	40,760	1900.....	121,363	197,000
1895.....	8,993	45,700	1901.....	14,583	70,000
1896.....	18,307	178,900	1902.....	58,076	123,500

Rafting is the only business done on the river.

A steamer is now being constructed to run from Columbia to the sea. The additional work proposed is necessary to make the improvement available.

For preliminary examination and survey see page 1140, Annual Report of the Chief of Engineers for 1885 (printed as House Ex. Doc. No. 254, 48th Cong., 2d sess.) For outline map of river see page 1194, Annual Report of the Chief of Engineers for 1889.

July 1, 1902, balance unexpended.....	\$27, 518. 59
June 30, 1903, amount expended during fiscal year	6, 037. 53
July 1, 1903, balance unexpended	21, 481. 06
July 1, 1903, outstanding liabilities	847. 94
July 1, 1903, balance available	20, 633. 12

(Amount (estimated) required for completion of existing project	185, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	45, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 4.)

5. *Congaree River, South Carolina, from Gervais Street Bridge, Columbia, to Granby.*—For original condition of this portion of the river see preceeding report on Congaree River, South Carolina.

Pursuant to House resolution dated December 15, 1893, a project and estimate were submitted January 2, 1894 (printed in House Ex. Doc. No. 66, 53d Cong., 2d sess.), for extending steamboat navigation from Granby to Gervais Street Bridge, Columbia, by the construction of a lock and movable dam near Granby. This document and a letter concerning it are printed on pages 1182–1189, Annual Report of the Chief of Engineers for 1896.

The river and harbor act approved March 3, 1899, appropriated \$50,000 for beginning this work, and authorized continuing contracts to be made for its completion, at a total cost not exceeding \$200,000 in addition to the \$50,000 appropriated. Three appropriations, aggregating \$200,000, have since been made for this work, completing the amount authorized by the act.

The total expenditures to June 30, 1903, were \$109,118.23. The necessary land had been acquired, lock keeper's house and other buildings constructed, and a careful survey of the site of lock and dam made. A contract for constructing the lock and dam abutment, except metal work, at a total cost, based on estimated quantities, of \$77,621, was approved October 20, 1900, the contract time for completion being January 30, 1902; and work under it has since been in progress, though greatly interfered with by an unusual number of freshets, especially in 1901. The contractors had completed the entire contract, except the riprap work below the abutment and an extension of the upper guide crib. On account of delays due to freshets authority was granted January 11, 1902, for a waiver of the time limit for completing this contract, the contractor to be required to complete within a reasonable time and to bear all expenses properly chargeable to him. The lock irons and gate members were purchased under a contract approved August 10, 1901. They had all been delivered, and the gates had been built by hired labor.

Contract was made October 2, 1902, for building the movable dam,

376 feet long, of Chanoine wickets. The plant for constructing the foundation of the dam had been erected, a dredge had been constructed for obtaining sand from the river for the concrete, and a small steamer had been built for towing. About 100 feet of cofferdam had been erected, which was washed away in the freshet of June, 1903.

There is no navigation at present on this portion of the river. The additional work proposed is necessary to make the improvement available. The usual range of water level at Columbia is about 33.2 feet.

July 1, 1902, balance unexpended	\$193, 423. 12
July 30, 1903, amount expended during fiscal year.....	52, 541. 35
July 1, 1903, balance unexpended	140, 881. 77
July 1, 1903, outstanding liabilities	6, 523. 70
July 1, 1903, balance available	134, 358. 07
July 1, 1903, amount covered by uncompleted contracts.....	75, 092. 70

(See Appendix O 5.)

6. *Inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville.*—These waterways consist of a series of creeks, sounds, rivers, and bays, which afford a route sheltered for the most part from the sea by the numerous islands which form the outer coast line. The route is tidal throughout, the range of tide varying from about 4.6 to 5.3 feet. It is now obstructed by a number of shallow reaches and narrow, crooked passages, particularly at points where the tides meet. The passage across Bulls Bay, besides being very shallow, is much exposed. The present commerce is comparatively small, as only very small vessels can get through without excessive delays.

The river and harbor act approved June 13, 1902, contains the following item:

Improving the inland waterways between Charleston Harbor, South Carolina, and opposite McClellanville, in accordance with the report submitted by the Chief of Engineers, March twenty-sixth, nineteen hundred and two, fifty thousand dollars, the same to be expended at the end of the route from Charleston northward in procuring a channel of four feet depth and sixty feet bottom width: *Provided*, That all land required for the same shall be relinquished free of cost to the Government.

The total estimated cost of improvement to the dimensions stated is \$125,290, the work to consist of improving present channels and of avoiding certain crooked and dangerous sections by canals.

The matter of obtaining title to the land required is in the hands of the Department of Justice.

For reports on preliminary examinations and surveys of portions of the route see Annual Report for 1887, page 1114, and Annual Report for 1890, page 1239. (See H. Ex. Doc. No. 82, 51st Cong., 1st sess.). For reports on preliminary examination of entire route from Charleston Harbor to Alligator Creek (beyond McClellanville) see Annual Report of the Chief of Engineers for 1900, page 1908 (printed also with map as H. Doc. No. 84, 56th Congress, 1st sess.).

July 1, 1902, balance unexpended	\$50, 000. 00
July 1, 1903, balance unexpended	50, 000. 00

{ Amount (estimated) required for completion of existing project	75, 290. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix O 6.)

7. *Charleston Harbor, South Carolina.*—There were originally four channels across the bar, the deepest having about 12 feet depth at low water. Commerce was then using the Pumpkin Hill channel, about 3 miles south of the present jetty channel. Where the present jetty channel is situated there was then the Swash channel, with a best depth of 10½ feet of water, too crooked for safe use. The natural channels were shifting in position and variable in depth.

The original project, adopted in 1878, provided for establishing and maintaining, by means of two jetties and auxiliary dredging, a low-water channel of not less than 21 feet depth across the bar. The Swash channel was selected for improvement. The estimated cost was \$3,000,000.

In 1888 it became necessary to modify the height of the crest line of the jetties and to revise the estimate. This increase in the estimate was largely due to the fact that money had been appropriated so slowly that reasonable contract prices could not be obtained. The annual appropriation up to that time had been only 5½ per cent of the original estimate. In the revised project the jetties were increased in height and length, but no change was made in their position or distance apart. The revised estimates were \$4,380,500 if the jetties were brought up to low-water level throughout, and \$5,334,500 if brought up 3 feet higher. The former estimate was adopted by Congress in the river and harbor act approved July 13, 1892.

The present project, adopted by the river and harbor act approved March 3, 1899, provides for obtaining a channel from Charleston to the ocean not less than 26 feet deep at mean low water (mean range of tide about 5.2 feet) and 600 feet wide, by constructing a large seagoing suction dredge, at a cost of not exceeding \$150,000, and operating her, together with the existing dredge *Charleston*, for three years. The estimated cost of constructing the new dredge and operating this dredge as above was \$285,000. Of this amount, \$175,000 had been appropriated prior to the enactment of the river and harbor act of June 13, 1902, which made available an additional sum of \$208,000, increasing to \$383,000 the amount authorized for the project for the new dredge and its operation.

The total expenditures to June 30, 1903, were \$4,304,823.96, including about \$2,500 expended at Sullivans Island and \$10,000 at Mount Pleasant. Of this amount, \$4,172,500 had been expended on the original project and on maintenance.

The jetties had been completed; a channel 21 feet deep at mean low water had been obtained in 1898; during the past year a channel with the project depth of 26 feet at mean low water was obtained. The project width has not yet been reached.

The new dredge begun in February, 1901, had been about 90 per cent completed on June 30, 1903. Details regarding its construction are given in Appendix I 6, herewith.

In view of the necessity of quickly increasing the entrance depth and width for the use of naval vessels, an estimate of \$98,000 for the fiscal year 1905 is submitted.

It is expected that report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

For original project see page 553, Annual Report for 1878. For history of operations to June 30, 1888, see page 970, Annual Report for

1888. For modified project, including estimates, see page 1150, Annual Report of the Chief of Engineers for 1889. For full history of all operations up to and including the completion of the jetties, with full discussion of the projects and costs, see page 1189, Annual Report of the Chief of Engineers for 1896. For project for securing a depth of 26 feet at low water from the ocean to deep water inside the harbor, see pages 1551-1557, Annual Report of the Chief of Engineers for 1899 (printed as House Doc. No. 83, Fifty-fifth Congress, third session).

COMMERCIAL STATISTICS.

[Furnished by the collector of customs.]

Foreign commerce.

Year.	Aggregate registered tons.	Value.	Year.	Aggregate registered tons.	Value.
1889	211, 203	\$16, 744, 951	1896	158, 325	\$11, 785, 846
1890	224, 962	16, 041, 397	1897	226, 750	12, 106, 763
1891	274, 149	23, 110, 664	1898	214, 180	10, 956, 250
1892	169, 379	11, 829, 607	1899	174, 525	6, 385, 168
1893	193, 336	11, 940, 129	1900	150, 631	11, 170, 910
1894	208, 169	11, 560, 372	1901	141, 003	5, 276, 757
1895	140, 988	10, 586, 326	1902	219, 069	7, 096, 294

Commerce through Charleston Harbor, ocean entrance.

Year.	Total imports and exports.	Value.
1901	Tons. 784, 812	\$29, 454, 515
1902	822, 845	34, 746, 997

The vessels using the entrance channel are steamers, sailing vessels, barges, etc. The steamers of the regular lines number 33, some of which, however, have made only one trip. The fruit imported by two companies has been brought by 21 vessels, making an aggregate of 89 trips. The business of the Clyde Steamship Company has been done by 12 vessels, running irregularly.

July 1, 1902, balance unexpended	\$202, 742. 33
Amount appropriated by sundry civil act approved March 3, 1903	60, 000. 00
April 16, proceeds auction sale Government property credited in Treasury United States	85. 00
	<u>262, 827. 33</u>
June 30, 1903, amount expended during fiscal year	65, 066. 29
July 1, 1903, balance unexpended	197, 761. 04
July 1, 1903, outstanding liabilities	4, 415. 87
July 1, 1903, balance available	<u>193, 345. 17</u>
July 1, 1903, amount covered by uncompleted contracts	78, 760. 00
(Amount (estimated) required for completion of existing project	98, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	98, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix O 7.)

8. *Wappoo Cut, South Carolina.*—Wappoo Cut in its original condition was a narrow, crooked tidal stream not over 2 feet in depth in some places. It connects Ashley and Stono rivers.

The existing project, adopted in 1881, revised in 1888, provides for straightening, widening, and deepening to secure a fairly direct channel 6 feet deep at mean low water and 60 feet wide. It includes the construction of two training walls at the Stono River entrance, revetting Elliotts Cut, constructing three closing dams, and dredging a cut 200 feet wide and 7 feet deep across the Ashley River bar. The estimated cost of the project was \$88,000, including expenditures between 1881 and its date.

The total expenditures to June 30, 1903, were \$62,628.56, of which amount about \$3,138.92 was for maintenance. A channel of the projected width and depth had been dug and the banks of Elliotts Cut revetted. Two of the closing dams had been built, and a cut of about 200 feet wide and 7 feet deep had been dredged across the Ashley River bar. A 6-foot channel 60 feet wide existed through the canal proper. The cut through the Ashley River bar had narrowed to 70 feet and shoaled to 6 feet.

The mean range of tide is about 5.5 feet.

Commercial statistics.

Year.	Total tons.	Value.	Year.	Total tons.	Value.
1891.....	140, 000	\$1, 976, 000	1896.....	271, 800	\$2, 410, 000
1892.....		1, 997, 500	1899.....	235, 830	2, 005, 695
1893.....	142, 800	1, 865, 500	1900.....	158, 849	2, 531, 899
1894.....	238, 350	1, 683, 000	1901.....	177, 320	2, 732, 600
1895.....	250, 230	2, 260, 100	1902.....	143, 165	2, 637, 481

The vessels using the cut were steamers of from 40 to 400 tons, sloops, lighters, rafts, etc.

Additional work proposed is necessary to make the improvement available.

July 1, 1902, balance unexpended	\$8, 000. 00
June 30, 1903, amount expended during fiscal year	128. 56

July 1, 1903, balance unexpended	7, 871. 44
--	------------

Amount (estimated) required for completion of existing project	17, 500. 00
--	-------------

(See Appendix O 8.)

9. *Inland waterway between Charleston and Beaufort, S. C.*—This waterway consisted originally of a series of creeks, sounds, rivers, and bays, affording a practicable route for small vessels, being well sheltered from the sea except at the crossing of St. Helena Sound. A 6-foot depth at mean low water existed throughout its length except in Wappoo Cut, Church flats, Mosquito Creek, and Brickyard Creek (part of Beaufort River). The first and last of these obstructions have been improved to depths of 6 and 7 feet, respectively. At Church flats the mean low-water depth is about 4 feet, and in Mosquito Creek about 2 feet. The latter is, moreover, extremely narrow and tortuous.

The river and harbor act approved June 13, 1902, contains the following item:

Improving inland waterway between Charleston and Beaufort, South Carolina, with a view to a connection between the South Edisto and Ashepoo rivers at or near Fenwicks Island, in accordance with the report printed on pages nine hundred and ninety-nine et sequentes in the report of the Chief of Engineers for eighteen hundred and eighty-eight, thirty thousand dollars.

The above item contemplates constructing a canal whereby the difficult passage through Mosquito Creek may be avoided. The cost of such a canal, 7 feet deep at mean low water and 90 feet wide at bottom, was estimated in 1888 as \$61,600.

The matter of obtaining title to the land required is in the hands of the Department of Justice.

The mean range of tide in the proposed canal will be about 7.5 feet.

Commercial statistics for Wappoo Cut are given under that head. Those for Brickyard Creek for the year 1900 are given on pages 1606 and 1607, Annual Report for 1901.

For report on preliminary examination and survey see page 999, Annual Report of the Chief of Engineers for 1888 (printed as House Ex. Doc. No. 117, Fiftieth Congress, first session).

July 1, 1902, balance unexpended.....	\$30,000. 00
June 30, 1903, amount expended during fiscal year	7. 40

July 1, 1903, balance unexpended	29,992. 60
--	------------

{ Amount (estimated) required for completion of existing project.....	31,600. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	10,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix O 9.)

10. *Beaufort River, South Carolina.*—There was originally a thoroughly good 7-foot channel between the town of Beaufort and Coosaw River, except at a point called Brickyard, near the Coosaw mouth. The least depth here was about 4 feet at low water, and the channel, when deep enough, was too narrow.

The plan of improvement adopted in 1890 was to deepen and widen the channel by dredging to give a continuous, sufficiently wide 7-foot channel at low water all the way through. The estimated cost was \$25,000. A layer of rock having been encountered at a higher level than was found by the preliminary borings, the work could not be completed for the amount of the original estimate. On April 15, 1893, the estimate was increased to \$40,000.

The total expenditures to June 30, 1903, were \$30,612.33. A channel 7 feet deep had been secured all the way through, but it was much too narrow at the point where rock was encountered. Considerable deterioration in depth and width had probably occurred since the last work was done. The mean range of tide is about 7.7 feet.

For report on preliminary examination see page 1235, Annual Report of the Chief of Engineers for 1890 (printed as House Ex. Doc. No. 42, 51st Cong., 1st sess.). For reasons for increasing estimate, see page 1529, Annual Report of the Chief of Engineers for 1893.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Commercial statistics, 1902.

[Commerce passing through Brickyard Creek.]

Year.	Tons.	Value.
1902	65, 668	\$571, 597

The vessels using the river were steamers of from 40 to 400 tons, schooners, sloops, lighters, rafts, etc.

July 1, 1902, balance unexpended	\$2, 407. 25
June 30, 1903, amount expended during fiscal year	19. 58

July 1, 1903, balance unexpended	2, 387. 67
--	------------

{ Amount (estimated) required for completion of existing project	9, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	7, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O 10.)

11. *Removing sunken vessels or craft obstructing or endangering navigation.*—Nothing was done during the year. There are a few sunken logs in the inland passage between Charleston and Beaufort, S. C., which have not seriously interfered with navigation. As some work is contemplated in the vicinity, these will be removed at the first favorable opportunity.

An allotment of \$2,000 was made for removing the wreck of an old vessel which had been converted into a phosphate barge, and which lies in Ashley River, near Lambs, S. C. Bids for the removal of this wreck were excessive and were rejected. The wreck will be removed by hired labor and the use of the Government plant.

The amount expended during the past year was 43 cents.

(See Appendix O 11.)

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN GEORGIA, OF INSIDE WATER ROUTE BETWEEN SAVANNAH, GA., AND FERNANDINA, FLA., AND OF CUMBERLAND SOUND, GEORGIA AND FLORIDA.

This district was in the charge of Capt. Cassius E. Gillette, Corps of Engineers, until April 28, 1903, and of Lieut. Col. James B. Quinn, Corps of Engineers, since that date. Division Engineers, Col. Peter C. Hains, Corps of Engineers (now brigadier-general, United States Army), to March 31, 1903, and Lieut. Col. James B. Quinn, Corps of Engineers, from March 31 to April 28, 1903.

1. *Savannah Harbor, Georgia.*—This covers the estuary of the Savannah River from about 2 miles above the city of Savannah to the ocean bar, about 22 miles below the city. In 1873 the channel was in places not more than 9 feet deep at mean low water.

The original plan of improvement is dated February 11, 1853, and another for removal of obstructions is dated about 1871. A later plan of improvement is dated August 28, 1873, and was supplemented March 19, 1879. It contemplated the establishment of a channel from the city to the sea, practicable at high tide for vessels drawing 22 feet of water. This project was replaced by an enlarged one (January 16, 1882, Annual Report of the Chief of Engineers for 1882, Appendix

J 4), contemplating the same channel depth. The amount expended under these projects up to June 30, 1890, was \$1,875,061.59.

The project in force up to June 13, 1902, adopted in 1890, providing for a mean high-water depth of 26 feet from the city to the sea, is printed as part of Appendix O, Annual Report of the Chief of Engineers for 1890. The channel depth contemplated by it was reported as having been obtained at the end of the fiscal year 1896. While the project depth was literally obtained, the channel was very crooked and of much less than the project width.

A supplemental plan of improvement was submitted December 7, 1894, providing for a detached extension of the Oyster Bed training wall, for the purpose of sheltering the anchorage in Tybee Roads, as well as for protecting the ship channel over the outer part of Tybee Knoll against the destructive action of heavy storms. This project, which is printed as part of Appendix M 1 of the Annual Report of the Chief of Engineers for 1895, was authorized by act of Congress of June 3, 1896, its estimated cost being \$992,250. The same act authorized the completion of work for improving the inside route from Savannah, Ga., to Beaufort, S. C., at an additional cost of \$106,700, and dredging for maintenance in Savannah Harbor, and the sum of \$1,005,000 was appropriated to complete these works.

The amount expended under the project of 1890 up to June 30, 1896, was \$3,460,049.99, of which \$974,504.88 was for dredging and \$2,356,720.10 for contraction work. There had been previously expended \$1,875,061.59, giving a total of \$5,335,111.58. Between June 30, 1896, and June 30, 1902, \$712,918.84 was expended on the modified 26-foot project, of which \$84,850.98 was for maintenance.

From the time of the reported completion of the project of 1890, in July, 1896, until June 30, 1902, extensive dredging has been done, both as maintenance and as part of the modification of the project.

The present project was adopted by act of Congress approved June 13, 1902, and is printed in House Document No. 123, Fifty-sixth Congress, second session, and also in the Annual Report of the Chief of Engineers for 1901, page 1723. The project provides for the establishment of a channel from the old waterworks above Savannah to the ocean, 28 feet deep at mean high water, with bottom widths of 350 to 500 feet; to be accomplished by dredging, and the raising of all existing training walls between Savannah and Tybee Roads. It also provides for the construction of mooring dolphins at two points in the harbor, the Bight and Venus Point. The estimated cost of the work is \$1,567,791.

The amount expended under the present project up to June 30, 1903, was \$202,067.95.

The total amount expended for the improvement of Savannah Harbor up to June 30, 1903, was \$6,250,098.37.

During the past fiscal year 1,055,990.9 cubic yards of material has been dredged from the harbor.

Plans and specifications for a dredge for this locality are being prepared and nearing completion. For details see Appendix I 6, herewith.

The controlling depth on June 30, 1903, was 17.5 feet on the shoal at Tybee Knoll, where the mean rise of the tide is 6.8 feet.

In 1872 the tonnage of vessels arriving and clearing at Savannah Harbor was somewhat more than 1,000,000, the total value of imports and exports about \$34,000,000. Cotton, lumber, wool, hides, naval

stores, and rice were principally dealt in. In 1890 the total tonnage was reported to have increased to about 2,000,000 and the value of imports and exports to \$152,000,000. Besides the articles named above, fruit, produce, and iron were handled extensively.

For the calendar year 1902 the total tonnage was 3,232,909, valued at about \$175,271,911.

The various projects of improvement will be found printed in the following documents:

Senate Executive Document No. 1, Thirty-third Congress, first session, and Annual Report of the Chief of Engineers for 1853, page 468.

Project for removal of Confederate obstructions. Annual Report of Chief of Engineers for 1872, page 653.

Project for 22 feet depth at high water, Annual Report of Chief of Engineers for 1873, page 736, and modifications in the following Reports: For 1875, Part II, page 34; for 1876, Part I, page 437; for 1880, Part I, page 933, and for 1882, Part II, page 1152.

Project for 26 feet depth at high water, Annual Report of the Chief of Engineers for 1890, Part II, page 1258, and modifications as follows: House Executive Document No. 115, Fifty-third Congress, third session; Annual Report of the Chief of Engineers for 1895, Part II, page 1459, and for 1900, Part III, page 1922.

Project for 28 feet depth at high water, House Executive Document No. 57, Fiftieth Congress, first session, and Annual Report of the Chief of Engineers, for 1888, Part II, page 1057; modifications in House Document No. 123, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, page 1719.

A detailed history of the work of improvement may be obtained by consulting Annual Report of the Chief of Engineers for 1888, Part II, page 1013, and Report for 1896, Part II, page 1218.

Maps showing the condition of the works at various dates may be found in the following documents:

Annual Reports of the Chief of Engineers for 1880, Part I, page 933; for 1885, Part II, page 1202; for 1888, Part II, page 1072; for 1891, Part II, page 1496; for 1896, Part II, page 1245; and for 1902, Part II, page 1178, and House Executive Documents No. 57, Fiftieth Congress, first session (1888), and No. 115, Fifty-third Congress, third session (1895).

July 1, 1902, balance unexpended.....	\$436, 867. 63
Amount received from sale of Government property.....	75. 00
Amount appropriated by sundry civil act approved March 3, 1903.....	720, 000. 00
June 30, 1903, amount expended during fiscal year.....	1, 156, 942. 63
	202, 067. 95
July 1, 1903, balance unexpended.....	954, 874. 68
July 1, 1903, outstanding liabilities.....	80, 184. 71
July 1, 1903, balance available.....	874, 689. 97
July 1, 1903, amount covered by uncompleted contracts.....	892, 933. 15
{ Amount (estimated) required for completion of existing project.....	280, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement.....	\$280, 000. 00
For maintenance of improvement.....	50, 000. 00
	330, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 1.)

2. *Savannah River, Georgia, below Augusta.*—Previous to improvement there were numerous shoals in the river with less than 3 feet at summer low water, the other obstructions consisting of overhanging trees, snags, and sunken logs. The aggregate length of river upon which there was less than 5 feet was about 9,800 feet, divided up into 10 shoals, and the controlling depth was about 2½ feet.

The original project, submitted December 22, 1880, provided for a 5-foot channel, 80 feet wide, by means of removal of snags, trees, sand bars, etc., and protection of banks, at a cost of \$91,000.

Under this project there was expended, prior to operations under the existing project, \$93,480.09.

The existing project, adopted in 1890, provides for the establishment of a navigable steamboat channel 5 feet deep at ordinary summer low water between the cities of Augusta and Savannah, to be accomplished by removing sand and gravel bars, regulating portions of the river, revetting caving banks, closing incipient cut-offs, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The total estimated cost of this improvement, in round numbers, is \$332,000, on the supposition that funds are regularly and adequately supplied, besides \$3,000 to \$5,000 annually for maintenance.

The amount expended upon the work under the existing project up to the close of the fiscal year ending June 30, 1903, was \$328,561.42, which, added to the amount previously expended, gives a total expenditure for this work of \$422,041.51.

The results of the work under the present project are as follows: The aggregate length of shoal water with less than 5 feet has been reduced to about 500 feet. A great many of the snags have been removed and great numbers of overhanging trees cut on the banks. The controlling depth at present is 4 feet at ordinary summer low water. The river occasionally falls perhaps a foot below this and rises more than 30 feet in time of floods, frequently standing for long periods at several feet above summer low water.

The district officer reports that it has not been possible to complete all the work embraced in the project of 1890, and believes that certain work should be done at an early date to secure the results contemplated in the project. There has been prepared an estimate of cost of the work remaining to be done.

Prior to the improvement the commerce was small, but its quantity unknown. At times since, previous to the construction of railroads, it has probably been greater than it is now, as since the advent of railroads the river has never been in a good navigable condition until recently. The commodities carried consist principally of cotton, naval stores, fertilizers, and general merchandise. Excluding timber, the tonnage for the year 1902 amounted to 55,530 tons, valued at \$3,353,585, besides 148,134 bushels of rice, valued at \$148,134, received at Savannah in small boats. There was also rafted down the river during 1902 about 24,972,901 feet B. M. of timber, valued at about \$324,647.71.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of the Chief of Engineers for 1881, Part II, page 1088, and House Executive Document No. 23, Forty-sixth Congress, third session. Modifications of original project,

Annual Report of the Chief of Engineers for 1886, Part II, page 1098, and for 1887, Part II, page 1166. Present project, Annual Report of the Chief of Engineers for 1890, Part II, page 1324, and House Executive Document No. 255, Fifty-first Congress, second session.

A detailed history of the work of improvement may be obtained by consulting Annual Reports of the Chief of Engineers as follows:

Report of 1888, Part II, page 1029; for 1890, Part II, page 1324, and for 1899, Part II, page 1569.

Maps showing the condition of the work at various dates may be found in the following documents:

House Executive Document No. 23, Forty-sixth Congress, third session; Annual Reports of the Chief of Engineers for 1883, Part I, page 908; for 1884, Part II, page 1106; for 1885, Part II, page 1210; for 1886, Part II, page 1094, and for 1902, Part II, page 1185, and in House Executive Document No. 255, Fifty-first Congress, second session.

July 1, 1902, balance unexpended	\$131, 446. 92
Amount received from sale of Government property	50. 00
June 30, 1903, amount expended during fiscal year	131, 496. 92
	99, 988. 43
July 1, 1903, balance unexpended	31, 508. 49
July 1, 1903, outstanding liabilities	6, 385. 84
July 1, 1903, balance available	25, 122. 65
July 1, 1903, amount covered by uncompleted contracts	13, 483. 16

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 2.)

3. *Savannah River, above Augusta, Ga.*—In its original condition the river, at low water, was navigable only with great difficulty on account of shallow water, obstructing logs, etc.

The original project of improvement, submitted February 8, 1879, provided for a 3-foot channel, 30 feet wide, from Augusta, Ga., to Trotters shoals, and the removal of snags, trees, etc., to the Tugaloo River, at a cost of \$45,000.

Under this project there was expended, prior to operations under the existing project, \$39,000.

The existing plan of improvement, adopted by Congress July 13, 1892, provides for the establishment, between Petersburg and the Locks, of a downstream channel 12 to 25 feet in width and navigable during ordinary summer low water for pole boats drawing 2 feet, and of an upstream channel navigable for pole boats drawing 1.3 feet of water. This is to be obtained by removing logs and overhanging trees; excavating rock, sand, or gravel, and with excavated materials raising crests of ledges; constructing training walls to increase flow of water through sluices. The total estimated cost is \$33,000.

The total amount expended under the present project up to June 30, 1903, was \$19,935.55, which, added to that previously expended, gives a total for this work of \$58,935.55.

The work accomplished under this project has given a downstream channel about 2 feet deep and an upstream channel of the project depth. In many places, however, these channels are difficult to navigate and are capable of greater improvement.

In 1876-77 about 2,000 tons of freight went upstream from Augusta and about 12,000 bales of cotton came down. In 1888 the down-going freight was estimated at about 5,000 bales of cotton, and in 1902 the total freight carried on the river, excluding timber, amounted to 2,940 tons, valued at \$196,997.

The various projects of improvement will be found printed in the following documents: Original project, Annual Report of the Chief of Engineers for 1879, Part I, page 747; present project, Annual Report of the Chief of Engineers for 1890, Part II, page 1366, and House Executive Document No. 213, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1888, Part II, page 1032, and for 1900, Part III, page 1930.

Maps may be found in the following documents: Annual Report of the Chief of Engineers for 1886, Part II, page 1094, and House Executive Document No. 213, Fifty-first Congress, first session.

July 1, 1902, balance unexpended	\$64. 45
July 1, 1903, balance unexpended	64. 45

{ Amount (estimated) required for completion of existing project	13, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix P 3.)

4. *Harbor at Darien, and Doboy bar, Georgia.*—(a) *Darien Harbor.*—In its original condition this harbor was obstructed at seven points by shoals with mean low-water depths of from 6½ to 10½ feet. Between the shoals there was nowhere less than 12 feet at mean low water.

There was expended on this harbor in 1879 for dredging \$8,000, without any project having been recommended or adopted.

The project for the improvement of this harbor, adopted in 1885, contemplates the establishment of a navigable channel 12 feet deep at mean low water between Darien and Doboy, at an estimated cost of \$170,000. Work was not begun under this project until 1891. The total amount expended under it up to June 30, 1903, was \$105,046.87, which, added to the amount previously expended, gives a total for this work of \$113,046.87. As a result, there is at present a low-water depth of about 12 feet on all of the shoals mentioned except the one in Old River, on which there is only 6 feet. Boats drawing 12 feet can, however, reach all the wharves at Darien at mean low water except through the channel to the Lower Ridge Mill. The mean rise and fall of the tide is about 6½ feet.

The total tonnage for 1878 was estimated at about 200,000 and the value of the exports at between \$600,000 and \$700,000. In 1902 the total annual trade, consisting almost entirely of timber, was estimated at 174,528 tons, valued at \$1,092,561.

By act of Congress approved June 13, 1902, this work was consolidated with Doboy bar, Georgia, and \$30,000 appropriated for their

improvement, of which amount \$24,000 has been allotted for Darien Harbor.

The present project will be found in the Annual Report of the Chief of Engineers for 1885, Part II, page 1238.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1895, Part II, page 1473, and for 1896, Part II, page 1253.

A map showing the jetties constructed will be found in the Annual Report of the Chief of Engineers for 1895, Part II, page 1477.

(b) *Doboy bar*.—In 1888 \$5,795.40 was spent in harrowing and water-jet work on this bar without result. In its original condition there was about 12 feet at mean low water in the old channel, which was very crooked, so that the entrance was not much used.

The project for its improvement, adopted by act of Congress of March 3, 1899, provides for creating a channel by dredging 24 feet deep at mean high water and 300 feet wide, estimated to cost \$70,000. The proposed channel is some distance north of the old channel.

The amount expended under the project up to June 30, 1903, was \$19,134.04, which, added to the amount previously expended, gives a total expenditure for this work of \$24,929.44.

By the act of Congress approved June 13, 1902, this work was consolidated with Darien Harbor.

During the years 1899 and 1900 about 120,000 cubic yards of material was removed. The contractor abandoned the work December 16, 1900, since which date nothing has been done, bids having been advertised to be opened March 21, 1902, but none were received.

This bar is in a transition stage, and the best line for dredging can be determined better after more settled natural conditions obtain. The latest reports indicate that the controlling depth on the bar in a practicable channel is 11 feet at mean low water. This is in the old channel, there being about 10 feet in the proposed channel. The tide rises 7.3 feet.

The commerce interested in this bar consists of lumber from the Altamaha River, the bulk of which is now shipped from Sapelo Sound and St. Simon Sound, north and south, respectively, of Doboy bar. During the calendar year 1902 it is estimated that about 10,000,000 feet B. M. of lumber, valued at \$130,000, crossed the bar.

The projects of improvement will be found printed in the following documents:

Original project, Annual Report of the Chief of Engineers for 1887, Part II, page 1179. Present project, Annual Report of the Chief of Engineers for 1897, Part II, page 1539, and House Document No. 13, Fifty-fifth Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers, as follows:

Report for 1887, Part II, pages 1179 and 1199; for 1888, Part II, page 1041; for 1899, Part II, page 1573, and for 1901, Part II, page 1639.

Maps may be found in the following documents:

Annual Report of the Chief of Engineers for 1888, Part II, page 1042; House Document No. 13, Fifty-fifth Congress, first session, and Annual Report of the Chief of Engineers for 1899, Part II, page 1573.

July 1, 1902, balance unexpended	\$80,876.42
June 30, 1903, amount expended during fiscal year	57.33
July 1, 1903, balance unexpended	80,819.09
July 1, 1903, amount covered by uncompleted contracts	17,000.00
{ Amount (estimated) required for completion of existing project	41,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix P 4.)

5. *Altamaha River, Georgia.*—Before improvement the Altamaha River was obstructed by rock ledges, sand bars, snags, sunken logs, and overhanging trees. The low-water depths at some points did not exceed 1 foot.

The original project of improvement, submitted in 1875, contemplated a channel 4 feet deep and 80 feet wide from Macon to Darien, by the removal of sand bars, rock, shoals, snags, overhanging trees, etc., at a cost of \$162,000.

Under it and its modifications there was expended up to June 30, 1890, \$69,776.59.

The existing project of improvement, adopted by Congress in 1890, provides for the establishment of a channel 3 feet deep at summer low water throughout the river above Darien. This is to be accomplished by removing rock, shoals, and sand bars, building deflecting dikes and closing incipient cut-offs, removing snags and sunken logs from the channel and overhanging trees from the banks of the stream, and revetting caving banks. The total estimated cost of the improvement is \$129,000, provided funds are regularly and adequately supplied, besides from \$3,000 to \$5,000 for annual maintenance.

The amount expended on the work under the present project up to June 30, 1903, was \$71,071.49, which, added to the amount previously expended, gives a total expenditure for this work of \$140,848.08.

This expenditure has resulted in the removal of one rock shoal, three sand bars, numerous snags, sunken logs, and overhanging trees. The greatest draft that can at present be carried at summer low water is about 2 feet by waiting for the tide at Coupers bar.

The commerce of the river before the improvement was begun was reported to have amounted to about 100,000 tons annually, valued at about \$1,000,000. During the calendar year 1902 it is estimated to have amounted to about 8,867 tons, valued at about \$620,690. There was also rafted down the river 102,540,980 feet B. M. of timber, valued at \$1,133,032.

The various projects of improvement will be found printed in the following documents:

Original project, Annual Report of the Chief of Engineers, 1875, Part II, page 670; modifications of original project, Annual Report of the Chief of Engineers for 1881, Part II, page 1107, and for 1887, Part II, page 1176; present project, Annual Report of the Chief of Engineers for 1890, Part II, page 1372, and House Executive Document No. 283, Fifty-first Congress, second session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers, as follows:

For 1888, Part II, page 1038; for 1889, Part II, page 1246; for 1892, Part II, page 1261; for 1900, Part III, page 1939.

Maps may be found in the following documents:

Annual Report of the Chief of Engineers, 1884, Part II, page 1116, and House Executive Document No. 283, Fifty-first Congress, second session.

July 1, 1902, balance unexpended	\$10, 218. 31
June 30, 1903, amount expended during fiscal year.....	6, 066. 39
July 1, 1903, balance unexpended	4, 151. 92
July 1, 1903, outstanding liabilities	54. 00
July 1, 1903, balance available	4, 097. 92
{ Amount (estimated) required for completion of existing project.....	102, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 5.)

6. *Oconee River, Georgia.*—In its original condition this river was used principally for navigation at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted January 29, 1875, and provided for the removal of snags, overhanging trees, etc., cutting off points, and making cut-offs, at a cost of \$10,150.

Under this project and its modifications there was expended, previous to the commencement of operations under the existing project, the sum of \$44,822.18.

The existing project of improvement was adopted by Congress September 19, 1890. It provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Milledgeville to the mouth. This is to be accomplished by removing rock shoals and sand bars, revetting caving banks, and closing incipient cut-offs, removing snags and logs from the channel and overhanging trees from the banks of the stream. The cost of the improvement is estimated at \$171,000, besides from \$3,000 to \$5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1903, was \$90,963.99, which, added to the amount previously expended, gives a total expenditure for this work of \$135,786.17.

As a result of this expenditure numerous snags and logs, bowlders, and overhanging trees have been removed, several cut-offs opened and others closed, and two training dikes built. The controlling depth at ordinary summer low water is probably about 2 feet. The river occasionally falls below this stage and frequently rises to considerable heights above it.

No reliable statistics of the commerce of the river before the improvement was begun are available. In 1902 the amount of freight carried on the river amounted to 7,781 tons, valued at \$622,480. Besides this, 28,704,000 feet B. M. of timber, valued at about \$373,152, was rafted down the river.

The various projects of improvement will be found in the following documents: Original project: Annual Report of the Chief of Engineers for 1875, Part II, page 41. Present project: Annual Report of the

Chief of Engineers for 1890, Part II, page 1432, and House Executive Document No. 211, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting Annual Reports of the Chief of Engineers for 1889, Part II, page 1253, and for 1900, Part II, page 1942.

Maps of the river will be found in House Executive Document No. 211, Fifty-first Congress, first session.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$25,093.27
June 30, 1903, amount expended during fiscal year	7,129.44
July 1, 1903, balance unexpended	17,963.83
July 1, 1903, outstanding liabilities	1,417.67
July 1, 1903, balance available	16,546.16
{ Amount (estimated) required for completion of existing project.....	114,900.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 6.)

7. Ocmulgee River, Georgia.—In its original condition this river was used for navigation chiefly at high stages. At low water there were numerous shoals and snags, there probably being less than 2 feet on many sand bars and rock ledges.

The original project was submitted in 1875, and provided for a channel 80 feet wide and 4 feet deep at low water, to be accomplished by the removal of sand bars, rock shoals, snags, overhanging trees, etc., from Macon to Darien, at a cost of \$162,000.

The amount expended under this project and its modifications prior to operations under the existing project was \$79,390.73.

The existing project of improvement, adopted by Congress September 19, 1890, provides for the establishment of a navigable channel 3 feet deep at ordinary summer low water from Macon to the river's mouth. This is to be obtained by removing rock shoals and sand bars, closing incipient cut-offs, revetting caving banks, and removing snags and logs from the channel and overhanging trees from the banks of the stream.

The cost of the improvement as given in the project of 1890 is estimated at \$210,000, provided funds are regularly and adequately provided, besides from \$3,000 to \$5,000 for annual maintenance.

The amount expended under the present project up to June 30, 1903, was \$218,077.31, which, added to the amount previously expended, gives a total expenditure for this work of \$297,468.04.

The work under the present project has resulted in marked improvement. Below Hawkinsville the navigable depth has been obtained throughout the river. Buttermilk shoal, the worst of a series of rock shoals above Hawkinsville (though several places where navigation is difficult need improvement), has been totally removed, and Town shoal, in the same vicinity, has been about half removed. At a series of sand bars just below Macon training dikes have been constructed.

Between Hawkinsville and Macon the controlling depth is still about

2 feet, as there are three rock shoals yet to be removed. The work near Macon has been only partially successful, as frequent freshets erode the banks and new shoals form at unexpected places.

No reliable statistics of the commerce of the river before the improvement was begun are available. In 1902 the amount of freight carried on the river amounted to 8,937 tons, valued at about \$625,590. Besides this, 34,139,980 feet B. M. of timber, valued at about \$443,820, was rafted down the river.

The various projects of improvement will be found printed in the following documents:

Original project: Annual Report of Chief of Engineers for 1875, Part II, page 670.

Modifications of original project: Annual Reports of the Chief of Engineers for 1882, Part II, page 1859; for 1885, Part II, page 1297; for 1886, Part II, page 1160, and for 1887, Part II, page 1276.

Present project: Annual Report of the Chief of Engineers for 1890, Part II, page 1458, and House Executive Document No. 215, Fifty-first Congress, first session.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1889, Part II, page 1258, and for 1900, Part II, page 1944.

Maps of the river will be found in House Executive Document No. 215, Fifty-first Congress, first session, and in Annual Report of the Chief of Engineers for 1902, Part II, page 1192.

July 1, 1902, balance unexpended	\$56,010. 73
Amount received on account of sales of Government property	106. 00
	56,116. 73
June 30, 1903, amount expended during fiscal year	42,978. 77
	July 1, 1903, balance unexpended
	13,137. 96
July 1, 1903, outstanding liabilities	2,700. 16
	July 1, 1903, balance available
	10,437. 80
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	8,000. 00

(See Appendix P 7.)

8. *Brunswick Harbor, Georgia.*—Previous to June 13, 1902, the projects under this title were for the inner harbor only, consisting principally of the removal of a shoal in East River, opposite the lower part of the city.

The original project of improvement, dated April 29, 1876, provided for the construction of a jetty at the city front and dredging, at a total cost of \$69,000.

Under this project and its modifications there was expended, prior to operations under the existing project, the sum of \$190,000.

The project in force up to June 13, 1902, was adopted by Congress in 1894. It provided for the maintenance of a navigable channel 15 feet deep at mean low water by keeping the existing works in repair and by dredging. The act of June 3, 1896, provided for the improvement of Academy Creek. The cost of maintaining a channel depth of 15 feet at mean low water was estimated at \$15,000 per annum.

There has been expended under this project up to June 30, 1902, \$34,817.25, all of which has been for maintenance.

Including \$10,000 spent in 1836 for dredging, the total amount expended up to June 30, 1902, on the inner harbor was \$234,817.25.

At present the controlling depth on the shoal in East River is 16.3 feet at mean low water; the rise of the tide is 6.6 feet. The channel is not self-maintaining.

The present project was adopted by act of Congress approved June 13, 1902, and provides for a navigable channel 21 feet deep at mean low water in Brunswick inner harbor, at a cost of \$120,000, and for a channel across the outer bar 19.3 feet deep at mean low water (26 feet at mean high water), at a cost of \$40,000. It also provides for dredging in Academy Creek at not to exceed \$5,000.

The amount expended under the present project to June 30, 1903, was \$27,692.36. This, added to the amount previously expended, gives a total expenditure for the work of \$262,509.61.

No work has yet been done on the outer bar by the Engineer Department. The amount available for this portion of the project is insufficient to do the work by contract, and it will have to be done by a Government seagoing dredge.

Before the improvement in 1880 the annual tonnage of the port of Brunswick was about 100,000, consisting chiefly of lumber, naval stores, wood, rice, and merchandise, valued at about \$1,700,000. In 1902 the total tonnage of the port amounted to 1,017,423 tons, valued at \$27,372,638.

The various projects of improvement will be found printed in the following documents:

First plan: Annual Report of the Chief of Engineers for 1876, Part I, page 489. First project: Annual Report of the Chief of Engineers for 1880, Part I, page 962. First revision of project: Annual Report of the Chief of Engineers for 1886, Part II, page 1113, and for 1887, Part II, page 1184. Second revision of project: Annual Report of the Chief of Engineers for 1895, Part II, page 1494. Third revision of project: House Document No. 40, Fifty-sixth Congress, first session. Project for bar: Annual Report of the Chief of Engineers for 1892, Part II, page 1327, and House Executive Document No. 34, Fifty-second Congress, first session. Revised project for bar: House Document No. 179, Fifty-sixth Congress, second session; House Document No. 355, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, Part II, page 1663.

A detailed history of the work of improvement may be obtained by consulting the Annual Reports of the Chief of Engineers for 1888, Part II, page 1047; for 1889, Part II, page 1258; for 1890, Part II, page 1407.

Maps showing the condition of the work at various dates may be found by consulting the following documents: Annual Reports of the Chief of Engineers for 1880, Part I, page 962; for 1881, Part II, page 1116; for 1883, Part I, page 922; for 1885, Part II, page 1228; for 1886, Part II, page 1116; for 1887, Part II, page 1196; for 1889, Part II, page 1266; for 1892, Atlas, page 58, and for 1893, Part II, page 1583, and House Executive Document No. 34, Fifty-second Congress, first session, and House Documents Nos. 40, Fifty-sixth Congress, first session, and 355, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended	\$165, 182. 75
June 30, 1903, amount expended during fiscal year	27, 692. 36
July 1, 1903, balance unexpended	137, 490. 39
July 1, 1903, outstanding liabilities	2, 126. 43
July 1, 1903, balance available	135, 363. 96
July 1, 1903, amount covered by uncompleted contracts.....	91, 871. 60
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	15, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 8.)

9. *Inside water route between Savannah, Ga., and Fernandina, Fla.*—This route consists of a series of bays and tidal sloughs, making a connecting waterway not exposed to rough water, except at a few points in stormy weather. The waters forming the route are shown on Coast Survey charts Nos. 156 and 157.

The project of improvement was adopted in 1892, and provides for the establishment of a channel 7 feet deep at mean low water. This is to be accomplished by the improvement of Romerly Marsh, Mud River, Little Mud River, and Jekyl Creek. The estimated cost of the improvement is \$105,000, provided the entire sum be made available at one time.

The total amount expended under this project up to June 30, 1903, was \$49,433.84, which, together with the amount expended for Jekyl Creek and Romerly Marsh, \$71,108.77, makes a total of \$120,542.61.

At present the controlling depths are as follows, beginning at the southern end: The Dividings, 5 feet; Jekyl Creek, 6 feet; Mud River, 4 feet; Parsons Cut, 4 feet, at mean low water.

The value of the commerce passing through this route was estimated in 1890 at between \$200,000 and \$400,000 per annum. For 1902 it amounted to about 31,579 tons of freight, valued at about \$2,210,530, and about 1,500,000 feet B. M. of timber, valued at \$1,500,000. None of this commerce passed over the whole extent of the route.

The present project will be found in the Annual Report of the Chief of Engineers for 1892, Part II, page 1309, and House Executive Document No. 41, Fifty-second Congress, first session.

A detailed history of the work of improvement will be obtained by consulting the Annual Reports of the Chief of Engineers, as follows: Report for 1892, Part II, page 1309; for 1893, Part II, page 1206, and for 1901, Part II, page 1653.

A map of the route will be found in House Executive Document No. 41, Fifty-second Congress, first session.

July 1, 1902, balance unexpended	\$15, 084. 34
June 30, 1903, amount expended during fiscal year	518. 18
July 1, 1903, balance unexpended	14, 566. 16
July 1, 1903, amount covered by uncompleted contracts.....	13, 000. 00
{ Amount (estimated) required for completion of existing project	41, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
30, 000. 00	

(See Appendix P 9.)

10. *Cumberland Sound, Georgia and Florida.*—In its original condition the available depth at the entrance varied from 11 to 12.5 feet at mean low water. The point of crossing the bar was subject to very great changes in location, moving in a series of years as much as 1½ miles.

The project of improvement submitted in 1879 and revised by a Board of Engineers in 1891 provides for the construction of two low jetties from the shores on opposite sides of the entrance and extending seaward across the bar upon lines so directed that the ends will be parallel to each other and about 3,900 feet apart. These jetties were intended to establish a low-water channel across the bar not less than 19 feet in depth. The cost of the improvement was originally estimated at \$2,071,023, and as modified at \$1,606,500, for the completion of low jetties, and at \$2,079,500 if high jetties were found necessary. There was expended under this project \$932,500.

The present project, which was adopted by act of Congress of June 3, 1896, provides for the establishment of a channel across the bar 19 feet deep at mean low water by the construction of two jetties of stone, resting on a foundation of brush mattresses, on the same lines as those in the previous project, the scour between the jetties to be aided by dredging, if necessary, the total cost of the improvement, at the time of this project, to be \$2,350,000, exclusive of amounts previously appropriated.

The amount expended under this project up to June 30, 1903, was \$1,941,863.01, which, added to the amount previously expended, gives a total expenditure for this work of \$2,874,363.01.

Jetty work was continued throughout the fiscal year, there being placed upon the two jetties 282,174.05 tons of stone. The seagoing dredge *Cumberland*, intended for this improvement, has been completed and removed 379,571 cubic yards of material between January 16 and May 28, 1903. Details of operations on dredge construction are given in Appendix I 6, herewith.

On June 30, 1903, the work was in a very satisfactory condition. A good straight channel exists, with a controlling depth of 24 feet at mean low water. The mean rise of the tide is 7 feet.

Before improvement (in 1879) the annual in and out bound tonnage at Fernandina was about 300,000, and the value of imports and exports about \$2,500,000, lumber, naval stores, and cotton being the principal articles. In 1902 the total tonnage of the port amounted to 665,441 tons, valued at \$4,694,496.

The project for this improvement will be found in the Annual Report of the Chief of Engineers for 1879, page 792, and the modifications in the Annual Report of the Chief of Engineers for 1891, Part II, page 1566, and Report for 1896, Part II, page 1289.

A detailed history of the work of improvement may be obtained by consulting the following documents:

Annual Reports of Chief of Engineers for 1876, Part I, page 459; for 1878, Part I, page 580; for 1883, Part I, page 934; for 1885, Part II, page 1232; for 1888, Part II, page 1054; for 1893, Part II, page 1599; and for 1897, Part II, page 1533; and Senate Executive Document No. 19, Fifty-second Congress, second session, and Senate Document No. 163, Fifty-fifth Congress, first session.

Maps showing the condition of the work at various dates may be found in the following documents:

Annual Reports of the Chief of Engineers for 1876, Part I, page 482; for 1888, Part II, page 1052; for 1889, Part II, page 1276; for 1891, Part II, page 1561; for 1892, Atlas, page 60; for 1893, Part II, page 1596; for 1898, Part II, page 1326; for 1899, Part II, page 1597; for 1902, Part II, page 1198, and in Senate Document No. 163, Fifty-fifth Congress, first session.

July 1, 1902, balance unexpended	\$646,068.67
Amount appropriated by sundry civil act approved March 3, 1903	400,000.00
	1,046,068.67
June 30, 1903, amount expended during fiscal year	^a 732,931.68
July 1, 1903, balance unexpended	313,136.99
July 1, 1903, outstanding liabilities	683,557.31
	229,579.68
July 1, 1903, balance available	
July 1, 1903, amount covered by uncompleted contracts	^c 24,987.74
	95,000.00
Amount (estimated) required for completion of existing project	95,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement	\$95,000.00
For maintenance of improvement	30,000.00
	125,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix P 10.)

11. *Removing sunken vessels or craft obstructing or endangering navigation.*—Authority was given for the removal of wreck of the schooner *Livingston*, sunk in Savannah Harbor, and \$1,000 was allotted for doing the work. The work of removal was awarded to John Rourke & Sons, of Savannah, Ga., for \$375. The wreck has not yet been removed.

Authority was also given for the removal of the three wrecks, *City of Austin*, *Franconia*, and *Puntalunos*, sunk in Cumberland Sound, Georgia and Florida, and \$9,570 was allotted for doing the work. Circulars inviting bids for removing these wrecks have been issued.

(See Appendix P 11.)

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF FLORIDA AND OF HARBOR AT KEY WEST, FLA., AND ENTRANCE THERETO.

This district was in the charge of Capt. Herbert Deakyne, Corps of Engineers, to September 24, 1902, and of Capt. Francis R. Shunk, Corps of Engineers, since that date. Division Engineers, Col. Peter C. Hains, Corps of Engineers (now brigadier-general, United States Army), to March 31, 1903, and Lieut. Col. James B. Quinn, Corps of Engineers, since that date.

1. *St. Johns River, Florida.*—Before improvement the mean low-water channel depth across the bar varied from 5 to 7 feet, with a tidal range of 5.22 feet. The bar was dangerous, as the channel shifted through a range of about 1 mile. The least mean low-water depth in

^aIncludes \$73,338.84 on account of construction of dredge.

^bIncludes \$204.30 on account of construction of dredge.

^cIncludes \$2,625 on account of construction of dredge.

the river was about 11.5 feet. The tidal range varies from about 4.5 feet at the mouth to 1 foot at Jacksonville.

The first project, adopted in 1879, contemplated a channel 15 feet deep at mean low water from Jacksonville to the ocean, a distance of about 27.5 miles. This was to be obtained by dredging and building training walls in the river, and by building two converging jetties of riprap stone 1,600 feet apart between their outer ends.

The present project, adopted in 1896, is to obtain a channel 300 feet wide and 24 feet deep from Jacksonville to the ocean by dredging through all shoals, building training dikes in the river, and by raising and extending the jetties. Estimated cost, \$2,109,750. The amount expended by the United States up to June 30, 1903, was \$1,866,143.33, of which \$439,872.52 was expended under the present project. Of this amount \$14,353.62 was for work of maintenance. Work ceased on the south jetty November, 1897; on the north jetty August 15, 1901.

The river and harbor act of June 13, 1902, appropriated \$350,000 for this improvement, and authorized a continuing contract for the work to an additional amount not exceeding \$950,000, and of said amounts an expenditure of \$150,000 was authorized for the purchase or construction of a seagoing suction dredge.

A contract for work on the jetties at the entrance was entered into March 6, 1903. Work under this contract began on the north jetty June 24, 1903.

The seagoing suction dredge authorized in act of June 13, 1902, is now under construction. For details of operations during the year reference is made to Appendix I 6, herewith.

A contract for dredging the river to obtain a depth of 20 feet was entered into February 25, 1903. Work under this contract should have commenced on or before May 27, but had not been begun at the end of the fiscal year.

A contract for the construction of training walls was entered into June 30, 1903.

On April 20, 1903, the Secretary of War authorized the construction of a river dredge, with a 30-inch dredging-pump outfit, for this improvement, using machinery already on hand. Bids for the construction of the hull of this dredge were opened June 30, 1903. The hull is to be completed within sixty-five days from date of notification of approval of the contract.

The U. S. dredge *Winyah Bay* worked on the shoals in the river from August 5 to October 4, 1902, and again began work February 4, 1903. This work was still in progress at the end of the fiscal year.

The maximum draft that can be carried at mean low water is 14 feet on the bar and 15½ feet in the river. The mean range of tide varies from 5.22 feet on the bar to 1.8 feet at Dames Point, the uppermost obstructing shoal.

Practically no work having been done on this improvement for nearly two years past, except for maintenance, there has been no increase in the facilities and advantages to commerce. The commercial statistics furnished by the Jacksonville Board of Trade show that the value of the commerce of Jacksonville during the year ending December 31, 1902, was about \$26,000,000.

More detailed information may be found in Report of the Chief of Engineers for 1895, pages 1586-1604; Report of the Chief of Engineers for 1896, pages 1305-1312, and Report of the Chief of Engineers for 1898, pages 1327-1330.

Tonnage by years.

1898.....	494, 474
1899.....	816, 477
1900.....	649, 221
1901.....	700, 179
1902.....	1, 710, 754

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$351, 804. 39
Amount appropriated by sundry civil act approved March 3, 1903	350, 000. 00
June 30, 1903, amount expended during fiscal year	701, 804. 39
	^a 41, 676. 91
July 1, 1903, balance unexpended	660, 127. 48
July 1, 1903, outstanding liabilities	^b 9, 601. 37
July 1, 1903, balance available	650, 526. 11
July 1, 1903, amount covered by uncompleted contracts.....	^c 519, 469. 32
{ Amount (estimated) required for completion of existing project	1, 009, 750. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
{ For works of improvement.....	\$500, 000. 00
{ For maintenance of improvement	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	525, 000. 00

MAINTENANCE.

July 1, 1902, balance unexpended	798. 26
June 30, 1903, amount expended during fiscal year	69. 07
July 1, 1903, balance unexpended	729. 19
July 1, 1903, outstanding liabilities	729. 19

(See Appendix Q 1.)

2. *St. Johns River at Orange Mills flats, Florida.*—Before improvement the St. Johns River between Jacksonville and Palatka was obstructed by four shoals, all near Orange Mills.

Forresters Point shoal, least depth 11.6 feet; Orange Mills flats, 9.8 feet; Racey Point shoal, 10.1 feet, and Tocoï shoal, 11.1 feet.

The project, adopted in 1898, is to dredge a channel 200 feet wide and 13 feet deep through the shoals between Jacksonville and Palatka, at an estimated cost of \$120,000.

A channel was dredged through Orange Mills flats in 1900, from 120 to 160 feet wide, connecting the 13-foot contours across the shoal.

The act of June 13, 1902, appropriated \$30,000 for this improvement. A contract for dredging was entered into October 26, 1902. Dredging began May 5, 1903. At the end of the fiscal year a total of 113,231.9 cubic yards had been dredged. The channel through Orange Mills flats was made 160 feet wide throughout, and a channel 120 feet wide was nearly completed through Racey Point shoal. The amount expended upon this improvement up to June 30, 1903, was \$46,038.32.

The available channel depth is now limited by Tocoï shoal to 11.1 feet.

^a Includes \$16,223.65 on account of construction of dredge.

^b Includes \$101.37 on account of construction of dredge.

^c Includes \$136,500 on account of construction of dredge.

The mean rise and fall of the tide in this locality is 0.9 foot.

The shoalest places have been deepened, and commerce has been materially benefited.

The commerce is chiefly in lumber, shingles, building material, and general merchandise.

Tonnage by years.

1898	25, 866	1901	67, 500
1899	122, 074	1902	137, 950
1900	171, 500		

July 1, 1902, balance unexpended	^a \$30, 277. 44
June 30, 1903, amount expended during fiscal year	6, 315. 76

July 1, 1903, balance unexpended	23, 961. 68
July 1, 1903, outstanding liabilities	8, 450. 00

July 1, 1903, balance available	15, 511. 68
---------------------------------------	-------------

July 1, 1903, amount covered by uncompleted contracts	13, 412. 18
---	-------------

{ Amount (estimated) required for completion of existing project	50, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q 2.)

3. *Volusia bar, Florida.*—The bar is located at the south end or head of Lake George, St. Johns River, about 162 miles from the mouth.

Before improvement the channel over the bar was very crooked and had a least depth at low water varying from 3½ feet to 4½ feet.

The project of 1879 contemplated the construction of two jetties carried out beyond the bar, with their outer ends from 200 to 250 feet apart. Estimated cost, \$15,000.

Two jetties have been built, starting from opposite sides of the river bank at the south edge of the lake and converging until upon the bar they are 230 feet apart. The east jetty is 3,400 feet long and the west jetty 2,200 feet. They are built to the level of mean low water throughout nearly their entire lengths. Two rows of piles with waling pieces confine boats to a 100-foot channel across the crest of the bar. This work was finished during 1899.

The amount expended to June 30, 1903, was \$31,000, of which \$6,000 was for maintenance.

No work has been done during the fiscal year.

The maximum draft that can be carried through the improved channel at low water is 5 feet.

The act of June 13, 1902, appropriated \$2,000 for maintenance, of which amount so much as may be necessary may be expended upon the St. Johns River between Volusia bar and Lake Monroe. It is proposed to remove the obstructions within the limits named to such an extent as the funds will permit. This work will be done when the proposed dredge and snag boat is available.

The commerce of this portion of the river is chiefly in grain, fertilizers, ship stores, vegetables, and general merchandise. The river traffic exercises a controlling influence on railway rates.

^aThe balance unexpended July 1, 1902, was given in Annual Report for 1902 as \$30,284.38; from this is to be deducted Treasury settlement No. 17830, February 25, 1902, for \$6.94, leaving a balance of \$30,277.44.

Tonnage by years.

1898	21,959	1901	32,437
1899	26,358	1902	53,678
1900	31,511		

July 1, 1902, balance unexpended	\$2,000.00
July 1, 1903, balance unexpended	2,000.00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q 3.)

4. *Oklawaha River, Florida.*—This river is obstructed by snags, accumulations of drift, and overhanging trees. After removal these obstructions recur in a few years.

The project adopted in 1891 is to clear the river of obstructions so as to give a navigable channel 4 feet deep at low stages from the mouth to Leesburg, a distance of 94 miles. Estimated cost, \$26,000.

The amount expended to June 30, 1903, was \$20,000, of which \$10,000 was for maintenance.

There is now a navigable channel 4 feet deep for a distance of 60 miles from the mouth.

No work was done during the year.

When the proposed dredge and snag boat is ready for work, the river will be dredged as far as the funds permit.

For more detailed description see Report of Chief of Engineers for 1896, pages 1314 to 1316.

The commerce involved in the improvement is small. The boats plying the river are chiefly excursion steamers, which run during the winter months for tourist travel.

Tonnage by years.

1898	4,481	1900	4,847
1899	4,291	1901	4,530

July 1, 1902, balance unexpended	\$2,000.00
July 1, 1903, balance unexpended	2,000.00

{ Amount (estimated) required for completion of existing project	16,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	8,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q 4.)

5. *St. Augustine Harbor, Florida.*—The original depth over the bar at the entrance to the harbor was from 6 to 9 feet at low water. The range of tide varies from 4 to 6 feet.

An examination of this harbor was made in 1887 with a view to its improvement. The act of August 11, 1888, appropriated \$35,000 for improving the harbor, subject to the report of a Board of Engineers. It was decided that it was inexpedient to undertake the deepening of the harbor entrance at that time. In accordance with the recommendation of the Board it was directed by Department letter of February 20, 1889, that the funds available be expended in checking the erosion of the shore lines of the harbor entrance.

The project provides for the construction of spur jetties, or groins, of concrete and riprap on brush foundation mattresses, with wing walls of riprap. The total estimated cost is \$95,000. Work was begun October, 1889, and seven groins have been built, varying in length from 220 to 549 feet. Three of these groins were built on North Beach and four on Anastasia Island. A total amount of \$71,000 has been appropriated. This work resulted in stopping the erosion on the north side of the entrance and checking that on the south side.

A break having occurred in the shore line of Anastasia Island in 1901, authority was given January 18, 1902, to expend the balance on hand in the construction of a timber dam and sand catches. This is now finished and has resulted in building up the shore to a height of about 8 feet.

During the year a few planks were added to the sand catches.

The work at St. Augustine is finished.

For more detailed description see Report Chief of Engineers for 1896, pages 1316, 1317.

The amount expended up to June 30, 1903, was \$70,720.86.

July 1, 1902, balance unexpended	\$928. 79
June 30, 1903, amount expended during fiscal year	649. 65
July 1, 1903, balance unexpended	279. 14

(See Appendix Q 5.)

6. *Indian River, Florida.*—(a) *Between Goat Creek and Jupiter Inlet.*—Before improvement the ruling depth in this portion of Indian River was 2½ feet; tide imperceptible.

The project of 1891 contemplates a continuous channel 5 feet deep at low water and at least 75 feet wide in the straight reaches, with as much greater width in the turns as might be required, at an estimated cost of \$44,000. In 1895 the channel previously dredged by the Florida Coast Line Canal and Transportation Company was widened at Long Canal, High Bank Canal, Curved Canal, and Conch bar by dredging along one side of it a cut 50 feet wide and 6 feet deep.

The amount expended on this part of the river to June 30, 1903, was \$15,000. No work has been done since February, 1895.

The act of June 13, 1902, appropriated \$2,000 for continuing the improvement. This amount not being sufficient to obtain noticeable results, it is proposed to defer the expenditure of the appropriation until more favorable conditions obtain or until additional funds may be provided.

From Goat Creek to St. Lucia River a maximum draft of 5 feet can be carried at mean low water. Between St. Lucia River and Jupiter Inlet the ruling depth is only 2 feet at mean low water. This shoaling is due to sand brought in through an artificial opening.

(b) *Negro Cut, Indian River Inlet.*—Before improvement the ruling depth was 2½ feet at mean low water.

The project adopted in the river and harbor act of August 18, 1894, contemplates dredging a channel 100 feet wide and 6 feet deep from the channel of Indian River through Negro Cut to the bar at Indian River Inlet and building a training wall for its protection at an estimated cost of \$32,775.

The channel called for by the project had been dredged by September 26, 1896, but being unprotected by the proposed training wall extensive shoaling occurred.

In 1901 the channel was redredged and two training walls built, one on each side of the channel at its eastern end. The north training wall is 560.7 feet long and the south training wall 880.6 feet long. The ruling depth is now 6 feet.

No funds being available no work was done at this place during the last fiscal year.

The amount expended on the improvement at Negro Cut to June 30, 1903, was \$32,500.

(c) *Jupiter Inlet*.—Before improvement the usual ruling depth at the entrance to Jupiter Inlet was 2½ feet at mean low water, but the inlet was at times entirely closed.

Being so closed, the entrance was opened in 1896 and again in 1901. Recent reports indicate that there is some danger of another closing.

The sum of \$1,500 has been expended on improvement of Jupiter Inlet.

Indian River is used only by small local steamers and launches and small sailing vessels. The through line of steamers which formerly ran has been taken off, being unable to compete with the railroad which parallels the river.

• *Tonnage by years.*

1901.....	66, 593
1902.....	91, 875

BETWEEN GOAT CREEK AND JUPITER INLET, INCLUDING NEGRO CUT.

July 1, 1902, balance unexpended	\$2, 350. 54
June 30, 1903, amount expended during fiscal year	350. 54
July 1, 1903, balance unexpended	2, 000. 00
{ Amount (estimated) required for completion of existing project	27, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Q 6.)

7. *Biscayne Bay, Florida*.—The navigation of Biscayne Bay in its natural condition is scarcely practicable for boats drawing 3 feet of water. The tidal range is about 1 foot. There is a narrow artificial channel with a least depth of about 11½ feet from Miami to the ocean through the southern entrance to the bay.

The project adopted by the river and harbor act of June 13, 1902, is to excavate a channel 18 feet deep from the wharves at Miami to the sea by way of a line entering the sea at a point about 4,000 feet north of Norris Cut, and a basin of same depth, 1,600 feet long and 500 feet wide, adjacent to the said wharves. There is also to be a basin to serve as a harbor of refuge at the eastern side of the bay, within the entrance. The act mentioned provides that, of the work contemplated, the Florida East Coast Railway Company shall construct, at its own expense, the basin adjacent to the wharves at Miami, and the channel from said basin to the east side of the proposed refuge basin on the east side of the bay; that the amounts appropriated and authorized shall be expended in constructing and protecting the portion of the channel extending to the sea from the terminus of the channel to be constructed by the railway company, of such approximately uniform depth and of such width as will best serve the interests of navigation

and as can be constructed with the funds therein appropriated and authorized. The act further provides that before any part of the appropriation shall be expended the said railway company shall enter into contract with the United States for the performing of its part of the work. This act appropriated \$50,000 and authorized a continuing contract for prosecuting the project for an additional amount, not exceeding \$250,000. This latter amount was appropriated by the sundry civil act approved March 3, 1903.

A contract for the portion of the work to be done by the Florida East Coast Railway Company was executed by said company September 25, 1902. A project for the expenditure of the available and authorized funds was approved January 12, 1903. The project contemplates the construction of a basin 300 by 500 feet at the east end of the channel, to be dredged by the railway company, and the excavation of a channel 18 feet deep and 100 feet wide, deepening to 20 feet at the ocean end, from the basin to the sea; also the construction of a breakwater extending from the present shore line seaward about 1,500 feet, 500 feet north of the proposed cut and parallel to it. The estimated cost of this work is \$300,000. By subsequent arrangement with the Florida East Coast Railway Company, it was agreed that work by the United States should not begin until the Florida East Coast Railway Company should have excavated a preliminary channel 10 feet deep and 60 feet wide across the bay. Work in this preliminary channel was begun in March, 1903, and at the close of the fiscal year a channel had been dredged by the railway company 60 feet wide and from 10.6 to 13.4 feet deep for a distance of 11,276 feet. Upon completion of this channel a further distance of about 4,274 feet operations will be commenced by the United States.

A description of the bay, with report and recommendations of a Board of officers, may be found in Report of the Chief of Engineers for 1900, pages 1986-2013.

The amount expended on this work up to the close of the fiscal year ending June 30, 1903, was \$755.10.

The commerce consisted of cattle, fertilizers, lumber, fruits, grain, and general merchandise, and amounted to 8,390 tons.

Tonnage by years.

1899	18,089
1902	8,390
July 1, 1902, balance unexpended	\$50,000.00
Amount appropriated by sundry civil act approved March 3, 1903	250,000.00
	300,000.00
June 30, 1903, amount expended during fiscal year	755.10
July 1, 1903, balance unexpended	299,244.90

(See Appendix Q 7.)

8. *Harbor at Key West, Fla., and entrance thereto.*—The entrance referred to is the northwest channel. Key West Harbor accommodates vessels drawing about 27 feet. Before improvement the ruling depth over the northwest bar was 10.5 feet. The mean tidal range is 2.6 feet.

The project adopted in 1889 contemplates a channel 17 feet deep at mean low water. This was to be secured by building two stone jetties, one to the northeast and one to the west of the channel, converging toward the bar, and by dredging if necessary. Estimated cost, \$500,000.

The east jetty has been built to a length of 11,354 feet and the west jetty to a length of 6,452 feet. The east jetty for a distance of 3,950 feet is at the height of mean low water. The rest of the jetty is about 5 feet below mean low water. The crest of the west jetty is about at the level of mean low water.

In 1901 the channel was dredged to about 12.5 feet. Since that time shoaling has taken place, especially at the turn inside the bar, so that vessels frequently have difficulty in passing.

The maximum draft that can be carried through this entrance at mean low water is 10 feet.

Authority was granted by the Secretary of War in April, 1903, for building a dredge for use in this work, plans and specifications for which are nearly completed. For details see Appendix I 6, herewith. No work is contemplated until this dredge shall be completed. It is proposed to apply the remaining funds to dredging, in order to give relief to commerce as speedily as possible.

The amount expended on this project to June 30, 1903, was \$362,730.59.

For more detailed information see Report of the Chief of Engineers for 1896, pages 1325-1327; Report of the Chief of Engineers for 1898, page 1371, and Report of the Chief of Engineers for 1900, page 1958.

It is expected that report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

The commerce is chiefly in cattle, fertilizers, tobacco, sponges, and general merchandise.

Tonnage by years.

1898	72, 968	1901	18, 863
1899	130, 713	1902	14, 146
1900	30, 594		

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$100, 170. 08
June 30, 1903, amount expended during fiscal year	400. 67

July 1, 1903, balance unexpended	99, 769. 41
--	-------------

(Amount (estimated) required for completion of existing project	100, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	50, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

MAINTENANCE.

July 1, 1902, balance unexpended	\$1, 013. 57
June 30, 1903, amount expended during fiscal year	1, 013. 57

(See Appendix Q 8.)

9. *Removing the water hyacinth from Florida waters.*—Before this work was begun many of the Florida rivers, especially the upper St. Johns and its tributaries, were overgrown with water hyacinths to such an extent that navigation was impeded.

The river and harbor act of March 3, 1899, appropriated \$25,000 for the construction of a boat for crushing the water hyacinths, \$1,000 for log booms, and \$10,000 for operating expenses. Before the boat was built experience in Louisiana showed that the crushing process

was too slow and expensive to be practicable, and a chemical process was recommended instead.

The act of June 13, 1902, appropriated \$50,000 for the removal of the water hyacinth from the navigable waters of the States of Florida, Texas, and Louisiana, and authorized the Secretary of War to use this amount and the unexpended balance of amounts theretofore appropriated for this purpose in the States of Florida and Louisiana in exterminating or removing the plant by any mechanical, chemical, or other means whatsoever.

On August 13, 1902, the Secretary of War authorized the adoption of a chemical process and the purchase of a steamer to be used for the work. The estimated annual expenditure was \$50,000.

The sum of \$25,000 was allotted for work in the State of Florida from the appropriation made in the act of June 13, 1902. A steamer was purchased and the work of spraying the water hyacinth with the Harvesta chemical compound was begun November 20, 1902. At the end of the fiscal year 2,910,000 square yards of hyacinths had been destroyed at various places on the St. Johns River and its tributaries. As a result the river at these places was freed from the obstruction. It is proposed to continue the spraying operations during the ensuing year.

The magnitude of this undertaking is becoming daily more manifest. The hyacinth multiplies so rapidly that losses are speedily made good, and every rise of water brings in enormous quantities from the swamps and creeks tributary to the river. The officer in charge of the district believes that it will be necessary to provide another boat and that not less than \$150,000 a year will be required for some years in order materially to improve the present conditions.

The commerce benefited is that of the upper St. Johns. (See improvement of Orange Mills flats.)

Further information is to be found in Report of the Chief of Engineers for 1899, pages 1612-1623, and Report of the Chief of Engineers for 1901, pages 1746-1749.

The amount expended on this project to June 30, 1903, was \$23,619.57.

July 1, 1902, balance unexpended	\$34, 915. 61
Allotted since	25, 000. 00
June 30, 1903, amount expended during fiscal year	59, 915. 61
	22, 535. 18
July 1, 1903, balance unexpended	37, 380. 43
July 1, 1903, outstanding liabilities	675. 00
July 1, 1903, balance available	36, 705. 43
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	50, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q 9.)

10. *Dredge for river and harbor improvements, Florida.*—The need for a light-draft self-propelling dredge and snag boat for operations on the harbors and streams in the State of Florida for which small appropriations are made from time to time, and the special features required in such a boat, are set forth in the Report of the Chief of Engineers for 1901, pages 1749 and 1750.

The river and harbor act of March 3, 1899, appropriated the sum of \$35,000 for the purchase or construction of such a boat. The amount was inadequate, and the act of June 13, 1902, contained an item appropriating \$35,000 in addition.

The amount expended to June 30, 1903, was \$4,214.57.

At the end of the fiscal year a contract had been signed, but not yet approved; cost, \$61,404.50.

July 1, 1902, balance unexpended	\$66,665.68
June 30, 1903, amount expended during fiscal year	880.25

July 1, 1903, balance unexpended	65,785.43
--	-----------

(See Appendix Q 10.)

11. *Removing sunken vessels or craft obstructing or endangering navigation.*—Five wrecks—the steamer *O. C. Williams*, schooner *Cottrell*, and three scows—were removed from Key West Harbor by James Owens, of Key West, Fla., under contract dated April 18, 1903, for \$665. The work was completed June 20, 1903.

(See Appendix Q 11.)

IMPROVEMENT OF RIVERS AND HARBORS ON THE WESTERN COAST OF FLORIDA SOUTH OF AND INCLUDING SUWANEE RIVER.

This district was in the charge of Capt. Herbert Deakyne, Corps of Engineers, to February 16, 1903, and of Capt. Francis R. Shunk, Corps of Engineers, since that date. Division Engineers, Col. Peter C. Hains, Corps of Engineers (now brigadier-general, United States Army), to March 31, 1903, and Lieut. Col. James B. Quinn, Corps of Engineers, since that date.

1. *Kissimmee River, Florida.*—The Kissimmee River rises in Lake Tohopekaliga, upon which the town of Kissimmee is situated. It flows generally in a southerly direction, through Cypress Lake, Lake Hatcheneha, and Lake Kissimmee, and empties into Lake Okechobee.

The length of the waterway from the town of Kissimmee to Lake Okechobee is 137 miles. The river is very tortuous and a number of cuts avoiding the worst bends have been made by private parties. Navigation is obstructed by shoals, snags, and overhanging trees.

The project adopted June 13, 1902, provides for a channel 3 feet deep at ordinary stages of the river, and 30 feet wide, from Kissimmee to Fort Bassinger, about 37.5 miles north of Lake Okechobee, and for a channel about 9.5 miles long, 3 feet deep, and 25 feet wide in Istokpoga Creek, about 10.5 miles north of Fort Bassinger. Estimated cost, \$24,220.90.

Work began April 2, 1903. At the end of the fiscal year a sheet-piling bulkhead 2,960 feet long had been constructed along one of the worst shoals, and the shoal reduced by dredging.

At ordinary stages a maximum draft of 15 inches can now be carried from Kissimmee to Fort Bassinger. The annual variation of level is about 4 feet. Kissimmee is the head of navigation.

The commerce of the Kissimmee River consists mainly in the transportation of general supplies from Kissimmee to the settlements along the river. It is expected that this commerce will be considerably facilitated by the proposed improvement.

July 1, 1902, balance unexpended	\$8,000.00
June 30, 1903, amount expended during fiscal year	4,980.17
July 1, 1903, balance unexpended	3,019.83
July 1, 1903, outstanding liabilities	650.00
July 1, 1903, balance available	2,369.83
{ Amount (estimated) required for completion of existing project	16,220.90
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix R 1.)	

2. *Orange River, Charlotte Harbor, and Caloosahatchee River, Florida.*—These improvements were consolidated by the river and harbor act of June 13, 1902. For description see Report of Chief of Engineers for 1900, pages 2033–2054.

(a) *Orange River.*—The stream, which enters the Caloosahatchee River from the south about 6 miles above the town of Myers, has a navigable length of 6 miles. Before improvement the limiting depth was about $2\frac{1}{2}$ feet at mean low water, with a tidal range of nearly 1 foot. Navigation was obstructed by shoals, snags, and overhanging trees.

The project, adopted by the act of June 13, 1902, provides for a channel 50 feet wide and 4 feet deep at mean low water from the mouth of the river to the head of navigation. The estimated cost of the improvement was \$2,500 and \$500 per year for maintenance.

Work began May 11, 1903, and was completed on June 8, 1903.

The amount expended to June 30, 1903, was \$934.50.

The improvement has resulted in the formation of a navigable channel 5 feet deep at mean low water from the mouth of the river to the head of navigation. This channel is 50 feet wide in the lower 3 miles. Above this the width between banks diminishes to 40 feet at the head of navigation.

The commerce of Orange River consists of fruit, fertilizers, lumber, and general merchandise, and for the year 1902 amounted to 7,155 tons.

(b) *Charlotte Harbor, and Caloosahatchee River between Puntarasa and Punta Gorda.*—The waterway to be improved between Punta Gorda and Myers is known as Pine Island Sound. It is obstructed by two shoals.

The project, adopted by the act of June 13, 1902, provides for a channel 100 feet wide, 7 feet deep at mean low water, through the shoal northeastward of Patricio Island and through the shoal northeastward of Blind Pass. The estimated cost of the improvement is \$6,000.

Operations for the improvement of Pine Island Sound were commenced by the U. S. snag boat *Surwancee* on April 13, 1903, and ceased on May 7, 1903.

The amount expended to June 30, 1903, was \$1,781.10.

There is now a channel 50 feet wide and 8 feet deep through Patricio Island shoal.

The improvement is not yet of benefit to commerce, since the depth over the shoal near Blind Pass has not been increased. The maximum draft that can be carried at mean low water is 5 feet.

The mean tidal range is about 1.7 feet.

The commerce of Charlotte Harbor consists of cattle, coal, fertilizers, fruit, grain, hay, and general merchandise.

Tonnage by years.

1897.....	112, 172	1900.....	85, 475
1898.....	106, 346	1902.....	46, 492
1899.....	102, 048		

Report of the examination of Charlotte Harbor authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

(c) *Caloosahatchee River between Puntarasa and Fort Thompson.*—Before improvements commenced upon this river there was a practicable channel 5 feet deep at mean low water from Puntarasa to a point 4 miles above Myers. Below Myers the river was obstructed by oyster bars. Above Myers the least depth in the river channel was 3½ feet over the shoal at Beautiful Island, and the river was obstructed by snags and overhanging trees.

The first project, adopted in 1882, was for deepening the channel to 7 feet at mean low water for a width of 100 feet from mouth of river to Myers. That project was modified in 1886 and 1888 to include improvement of the river from Myers to Fort Thompson by removal of snags and overhanging trees and by deepening the channel to 4 feet at mean low water through the shoal at Beautiful Island. The sum of \$33,600 was expended under this project.

The project was completed in 1892, but shoaling has since taken place.

The project for expenditure of funds now available, approved October 22, 1902, is for maintenance of the improvement between Myers and Fort Thompson and for straightening and widening the channel to 100 feet and dredging it to 7 feet depth at mean low water between Puntarasa and Myers. The estimated cost is \$1,500.

Work began June 9, 1903.

No payments had been made on the present project to the close of the fiscal year ending June 30, 1903.

The commerce of Caloosahatchee River consists of cattle, fertilizers, fruit, grain, hay, lumber, and general merchandise.

Tonnage by years.

1899.....	33, 101
1900.....	22, 737
1902.....	27, 895
July 1, 1902, balance unexpended	\$9, 500. 00
June 30, 1903, amount expended during fiscal year	2, 715. 60
July 1, 1903, balance unexpended	6, 784. 40
July 1, 1903, outstanding liabilities	1, 000. 00
July 1, 1903, balance available	5, 784. 40

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	2, 000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	(See Appendix R 2.	

3. *Sarasota Bay, Florida.*—Before improvement there was a navigable channel with a least depth of 5 feet throughout the length of Big Sarasota Bay, excepting in two reaches, Palma Sola Pass and Long bar, which have a total length of 5,400 feet. In these reaches the least depth was 4.3 and 3.5 feet, respectively. Mean tidal range, 1.5 feet.

Between Sarasota and Caseys Pass, at the south end of the bay, the least channel depth was 1.2 feet at mean low water, except at the Mangroves, where it was nothing. The original project adopted in 1889 contemplated the formation of a continuous channel 100 feet wide and 5 feet deep at mean low water from Tampa Bay to the town of Sarasota, Fla., a distance of 21½ miles, the estimated cost being \$17,500.

In 1896 the project was modified to provide for a channel 75 feet wide and 3 feet deep from Sarasota to Caseys Pass.

The total estimated cost of the modified project is now \$55,000. The amount expended to June 30, 1903, was \$22,446.20. As a result a draft of 5 feet can be carried through the cuts in Sarasota Bay, and 3 feet through the cuts in Little Sarasota Bay.

The larger portion of the commerce is transported by water. The channel affords an inside passage for small coastwise vessels.

Tonnage by years.

1900.....	9, 424
1901.....	9, 349
1902.....	4, 313
July 1, 1902, balance unexpended	\$5, 000. 00
June 30, 1903, amount expended during fiscal year	4, 946. 20
July 1, 1903, balance unexpended	53. 80
{ Amount (estimated) required for completion of existing project	32, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix R 3.)

4. *Tampa Bay, Florida.*—Before improvement vessels drawing 12 feet could enter the bay and reach Ballast Point, while vessels drawing 8 feet could reach Tampa by taking advantage of the tide. Prior to 1888 operations were confined to dredging a 9-foot channel to Tampa under project adopted in 1880. In 1888 provision was made for a channel 200 feet wide and 20 feet deep at mean low water from the Gulf to Port Tampa. This was completed May 12, 1892. On these projects the sum of \$130,000 was expended, \$80,000 being applied to Hillsboro River and Bay.

The present project was adopted March 3, 1899. It contemplates a channel 27 feet deep from the Gulf of Mexico to Port Tampa, 500 feet wide across the bar and 300 feet wide in the bay. It is proposed first to secure a channel of full width and 24 feet deep throughout, and afterwards to increase this depth to 27 feet. Estimated cost, \$750,000. The work is being done under a continuing contract with the Alabama Dredging and Jetty Company.

The amount expended under the present project to June 30, 1903, was \$253,694.18.

At present there is a channel with a least depth of 24 feet from the Gulf to Port Tampa. The least width of this channel is 72 feet for a

very short distance; another short section has a width of 128 feet. Most of the channel is 300 feet wide.

The mean range of tide at the bar is 1.54 feet; at Port Tampa, 1.95 feet.

The commerce of Tampa is large and increasing; it is chiefly in fertilizers, fruit, tobacco, naval stores, and general merchandise.

Tonnage by years.

1896	276, 638	1900	350, 761
1898	136, 156	1901	416, 503
1899	238, 305	1902	462, 703

July 1, 1902, balance unexpended	\$251, 044. 19
Amount appropriated by sundry civil act approved March 3, 1903	186, 337. 76

	437, 381. 95
June 30, 1903, amount expended during fiscal year	81, 063. 37

July 1, 1903, balance unexpended	356, 318. 58
July 1, 1903, outstanding liabilities	24, 000. 00

July 1, 1903, balance available	332, 318. 58
---------------------------------------	--------------

July 1, 1903, amount covered by uncompleted contracts.....	293, 124. 46
--	--------------

Amount (estimated) required for completion of existing project	139, 987. 24
--	--------------

(See Appendix R 4.)

5. *Hillsboro Bay, Florida.*—The city of Tampa is located at the head of Hillsboro Bay at the mouth of Hillsboro River. It is separated from the 12-foot depth in the bay by a flat about 3 miles wide. Originally there existed through this flat a narrow channel with an average available depth of about 5 feet, formed by the waters of Hillsboro River. Mean tidal range is 2.2 feet.

The original project was adopted in 1880, and had for its object the formation of a 9-foot channel, 150 feet wide in the bay and 200 feet wide in the river, from the 9-foot curve in the bay to the wharves at Tampa in the Hillsboro River. In 1888 the project was modified to provide for the formation and maintenance of a channel 8 feet deep in Hillsboro Bay and Hillsboro River to the city of Tampa, and a channel 20 feet deep and 200 feet wide from the outer bar to Port Tampa. The total amount expended on this improvement to June 30, 1898, was \$80,000. At that date the channel at the mouth of the river was about 200 feet wide and 9 feet deep, but in the channel below there were places where the depth was only 7 feet and the width less than 80 feet.

The present project, adopted March 3, 1899, contemplates the formation of a channel in Hillsboro River from a point about 100 feet south of the bridge crossing the river at Lafayette street in the city of Tampa to the mouth of the river, and from there along the line of shortest distance to the 12-foot contour in Hillsboro Bay; this channel is to be 12 feet deep at mean low water, 200 feet wide in the river, and 150 feet wide in the bay. The estimated cost of the proposed work is \$300,000, with \$1,000 annually for maintenance.

The amount expended under the existing project to June 30, 1903, was \$213,609.54.

The result of this work is greatly to facilitate navigation.

The channel is approaching completion, but has not its full width.

At mean low-water level a draft of 12 feet can be carried from the 12-foot contour in Hillsboro Bay to the Lafayette Street Bridge over Hillsboro River, Tampa.

The head of navigation is Sulphur Springs Bridge.

The commerce is mainly in fertilizers, grain, hay, building material, and fruits.

Tonnage by years.

1898.....	32,070	1901.....	131,208
1899.....	110,240	1902.....	169,844
1900.....	361,323		

For further information see Report of the Chief of Engineers for 1899, and pages 2025 to 2027, Part III, of the Report for 1900, and pages 1222 and 1223 of the Report for 1902.

It is expected that report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$159,292.87
June 30, 1903, amount expended during fiscal year	97,902.41
July 1, 1903, balance unexpended	61,390.46
July 1, 1903, outstanding liabilities	11,000.00
July 1, 1903, balance available	50,390.46
July 1, 1903, amount covered by uncompleted contracts.....	45,510.64

{ Amount (estimated) required for completion of existing project	25,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	2,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R 5.)

6. *Crystal, Manatee, Anclote, Suwanee, and Withlacoochee rivers, Florida.*—These improvements were consolidated by the act of June 13, 1902, which appropriated \$35,000 to be applied to the five rivers. The act also appropriated the additional sum of \$15,000 to be applied to deepening the channel from the mouth of the Withlacoochee River to the loading pool in the Gulf of Mexico to a depth of 8 feet. Allotments from the consolidated appropriation were made on October 24, 1902.

(a) *Crystal River.*—Crystal River is a small tidal estuary emptying into the Gulf of Mexico on the west coast of Florida about 25 miles southeast of Cedar Keys. It is navigable to the town of Crystal River, 6½ miles from the mouth. The entrance is obstructed by reefs and sand bars. Through these reefs and bars there is a difficult and tortuous channel, with a ruling depth of 2.7 feet at mean low water. There is also a shoal near Crystal River having a depth of less than 6 feet.

The project contemplates a channel through the shoal places 6 feet deep at mean low water and 60 feet wide. The estimated cost is \$84,647.46.

The amount expended to June 30, 1903, was \$1,253.83.

The town of Crystal River is the center of a productive region some 400 square miles in area, rich in phosphate deposits. Other products

of this region are fruits, fish and oysters, lumber, and naval stores. For description see Report of Chief of Engineers, 1900, pages 2075-2078.

Tonnage by years.

1902 1,785

(b) *Manatee River*.—This river has an estuary 12 miles long. Before improvement the general depth of the river in the estuary varied from 7 to 20 feet. At the mouth there was a long shoal with a depth of 7 feet. Between Palmetto and Braidentown there was another bar with least depth of 3 feet. The head of navigation is Rye, 20 miles from the mouth.

A project adopted in 1882 contemplated a channel 100 feet wide and 13 feet deep from Tampa Bay to Shaw and McNeills points.

In 1886 the project was so modified as to provide for a channel 100 feet wide and 8 feet deep at mean low water from Tampa Bay to Manatee, Fla.

This channel was completed, and in 1892 the original project was again adopted. The revised estimate for this work is \$73,000.

A project for making a channel through Terraceia Cut-off, 100 feet wide and 6 feet deep, was approved June 3, 1897; estimated cost, \$20,000. Before improvement there was a channel through this cut-off 1 foot deep at mean low water.

The amount expended to June 30, 1903, was \$59,301.16. As a result the cut-off is 100 feet wide and 6.5 feet deep at mean low-water level. The least depth between the Manatee River and Braidentown is 9 feet; from Braidentown to Ellenton, 8 feet; from Ellenton to Rocky Bluff, 7 feet, and from Rocky Bluff to Rye, 1.5 feet.

The commerce of the river is in fruits, vegetables, naval stores, lumber, fuller's earth, and general merchandise. The country adjacent to the river is being rapidly developed and its commerce is growing.

Tonnage by years.

1898	23, 800	1900	55, 162
1899	43, 542	1902	34, 495

For further information see Reports of Chief of Engineers for 1896, pages 1332 and 1333; for 1900, pages 2020 and 2021, and for 1902, page 1223.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

(c) *Anclote River*.—Before improvement the river below Tarpon Springs was obstructed by shoals and bars, with depth varying from 2 to 14 feet at mean low water. The channel was narrow and tortuous. Tidal range, 2 feet.

The project was adopted March 3, 1899, and contemplates a channel 100 feet wide and 6 feet deep at mean low water from Anclote Anchorage to Sponge Harbor, and thence 4 feet deep at mean low water to the county bridge at Tarpon Springs, the head of navigation, at an estimated cost of \$51,500.

The amount expended to June 30, 1903, was \$6,198.15.

A cut 50 feet wide and 7 feet deep at mean low-water level has been made through the worst shoals. The ruling depth is 3 feet.

No work was done during the year ending June 30, 1903.

The commerce of this locality is in lumber, fruit, and sponges.

Tonnage by years.

1899.....	1,441
1900.....	1,000

For further information see Reports of the Chief of Engineers for 1895, pages 1573-1576; for 1898, pages 1361-1363; for 1900, page 2023, and for 1902, page 1223.

(d) *Suwanee River*.—Before improvement, the river from its mouth to Ellaville, a distance of 135 miles, was obstructed by snags, overhanging trees, and shoals of soft unstratified limestone. The channels across these shoals were narrow and crooked, with depths varying from 15 inches to 3 feet. At places there were large limestone bowlders in the channel.

The estimated cost of the work to be done was \$55,158.

The project adopted in 1879 is to deepen the bar at the entrance by dredging, to remove snags and overhanging trees along the river, and to deepen and improve the channel by removing rocks and snags and building wing dams. The channel is to be 150 feet wide and 5 feet deep from the mouth to Rollands Bluff, 75 miles; thence 60 feet wide and 4 feet deep to Ellaville, the head of navigation, 60 miles.

The amount expended to June 30, 1903, was \$55,813.05.

The maximum draft that can now be carried at low water is 5 feet from the Gulf to Branford (Rollands Bluff) and 5 feet from there to Hudson, 10 miles below Ellaville.

The mean range of tide at the mouth of the Suwanee River is 2.4 feet.

The commerce of the river is chiefly in agricultural products, fertilizers, lumber, and naval stores.

Tonnage by years.

1898.....	106,346
1899.....	76,878

For further information see Reports of the Chief of Engineers for 1896, pages 1335-1336; for 1898, pages 1341-1342, and for 1902, pages 1224 and 1225.

(e) *Withlacoochee River*.—Before improvement this river was obstructed by ledges of limestone rock, and sand bars, snags, and overhanging trees. The general depth was from 1 foot to 7.5 feet, with a width of from 75 to 180 feet. The obstructions prevented regular navigation and the river was used only for rafting cedar logs. Mean range of tide, 2.8 feet.

The old project, adopted in 1879, provided for a channel having an available depth of 2 feet during about half the year, from the mouth of the river in the Gulf of Mexico to Pemberton's Ferry, a distance of 77 miles. The project was practically completed November 14, 1892.

The improvement has not resulted in any marked benefit to commerce, because the navigation period does not coincide with the commercial season.

The amount expended under the old project was \$24,403.62.

The maximum draft that can be carried in the river to the head of navigation, Pemberton's Ferry, is 2 feet.

The present project was adopted June 13, 1902. It provides for deepening the channel from the mouth of the Withlacoochee River to

the loading pool in the Gulf of Mexico, being a distance of 11,780 feet, to the depth of 8 feet at mean low-water level, and straightening said channel where it is crooked, and for maintenance. Work of maintenance under the old project is to continue.

The amount expended under the new project to June 30, 1903, was \$499.32.

The least depth between the loading pool in the Gulf of Mexico and Port Inglis, 5 miles above the mouth of the river, is 5.8 feet at mean low water.

The entrance is being improved by the Dunnellon Phosphate Company, at its own expense.

The commerce of the river is in phosphate, lumber, and general merchandise. The increase of water tonnage has recently been great.

For further information, see Reports of the Chief of Engineers for 1898, pages 1340, 1341, and 1363-1369; and for 1902, page 1224.

Tonnage by years.

1899.....	4,941
1900.....	2,550
1902.....	74,047

CONSOLIDATED APPROPRIATION.

July 1, 1902, balance unexpended	\$35,411.33
June 30, 1903, amount expended during fiscal year	5,681.14
July 1, 1903, balance unexpended	29,730.19
{ Amount (estimated) required for completion of existing project	133,305.46
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	^a 70,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

CHANNEL FROM WITHLACOOCHEE RIVER TO LOADING POOL IN GULF OF MEXICO.

July 1, 1902, balance unexpended	\$15,000.00
June 30, 1903, amount expended during fiscal year	499.32
July 1, 1903, balance unexpended	14,500.68
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	(^b)
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix R 6.)	

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN GEORGIA AND FLORIDA AND IN EASTERN ALABAMA.

This district was in the charge of Capt. Robert R. Raymond, Corps of Engineers, to June 1, 1903, and of Capt. J. B. Cavanaugh, Corps of Engineers, since that date. Division Engineer, Lieut. Col. H. M. Adams, Corps of Engineers.

^a Includes \$1,000 for maintenance of channel from mouth of Withlacoochee River to the loading pool in the Gulf of Mexico.

^b An estimate of \$1,000 for maintenance of this improvement is included in the estimate of \$70,000 submitted for Crystal, Manatee, Anclote, Suwanee, and Withlacoochee rivers.

1. *East Pass and Carrabelle bar and harbor, Florida.*—The town of Carrabelle is situated about 25 miles east of Apalachicola, at the mouth of the Carrabelle River, which empties into St. George Sound. The river forms the inner harbor, and along the water front its channel varies from 9 to 15 feet in depth, with a minimum width of about 100 feet.

Dog Island anchorage, a protected portion of St. George Sound, showing a 4-fathom depth over a considerable area, forms the outer harbor. Between the 10-foot contours in the inner and outer harbors there is a bar about 6,000 feet wide, which originally had a minimum low-water depth over it of $3\frac{1}{2}$ feet to 4 feet.

Dog Island anchorage is connected with the Gulf of Mexico by East Pass, which has limiting low-water depths of about 17 feet.

The river and harbor act of June 3, 1896, adopted a project, and appropriated \$10,000 to be used in making a 10-foot channel by dredging from the mouth of Carrabelle River to the channel in the bay (St. George Sound), and on March 3, 1889, \$10,000 more was appropriated for continuing the work; but the width of the channel was not fixed, and no estimate of the cost of the improvement had been included in the project.

The emergency river and harbor act of June 6, 1900, provided for an examination and survey of Carrabelle Harbor. Report upon same is published in Annual Report of the Chief of Engineers for 1901, page 1800 et seq., and printed in House Document No. 227, Fifty-sixth Congress, second session.

This report contemplates securing a channel 10 feet deep and 100 feet wide from Dog Island anchorage (St. George Sound) to the city of Carrabelle, at a cost of \$47,800, in addition to appropriations already made and expended. This estimate is the only one made from an actual survey, and may be considered to be in accordance with the project already adopted by Congress June 3, 1896, and practically an estimate of the cost of its completion.

The river and harbor act of March 3, 1899, provided for examination of East Pass. Report upon the same, with plan and estimates for improvement, is published on page 2152 et seq., Annual Report of the Chief of Engineers for 1900. The project proposed in this report provides for securing a channel across the sea bar $20\frac{1}{2}$ feet deep and 150 feet wide, at a cost of \$18,950, and closing an opening in Dog Island, at a cost of \$8,500. The river and harbor act of June 13, 1902, appropriated \$20,000 for the work on this project, and steps have been taken to expend this amount in dredging.

The amount expended up to the close of the fiscal year ending June 30, 1903, was \$21,976.94.

The maximum draft that could be carried through the channel to the inner harbor at mean low water on June 30, 1903, was 6 feet, this limiting depth being confined to the inner end of the channel, as it has otherwise a depth of over 7 feet throughout its length. The channel seems to be practically permanent, as no shoaling has been observed recently, but at the inner end, beyond the dredged cut, it is very narrow and crooked, and should be widened and straightened.

The ordinary range of the tide is about 2 feet.

The commerce of the port of Carrabelle, Fla., consists principally of timber, naval stores, dressed and kiln-dried lumber, shingles, and miscellaneous articles. The value of exports, foreign and domestic, of

lumber and naval stores during the fiscal year has been returned at \$393,947.27.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	272.86

July 1, 1903, balance unexpended	19,727.14
--	-----------

{ Amount (estimated) required for completion of existing project	54,750.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.	30,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S 1.)

2. *Harbor at Apalachicola Bay, Florida.*—The town of Apalachicola lies at the mouth of the river of that name, of which the deep water along the river front forms the inner harbor. Between the inner harbor and the 3-fathom anchorage area in Apalachicola Bay there is a bar at the mouth of the river, of which the original width between 8-foot contours was 7,000 feet and the minimum depth of water 3.5 feet.

Across this bar the lumber exported is lightered either to the 3-fathom anchorage in Apalachicola Bay or through Bulkhead shoals to the anchorage of Carrabelle, 25 miles distant. The 3-fathom anchorage area is entered via West Pass, where originally the depth was about 13 feet. The original depth over Bulkhead shoals was less than 4 feet.

The original project, approved June 14, 1880, provided for dredging a channel 100 feet wide and 11 feet deep through the bar at the mouth of the river, the width of cut to be increased to 200 feet if the results justified this enlargement.

This project was amended September 19, 1890, to include dredging a channel 9 feet deep and not less than 100 feet wide across the Bulkhead shoals.

Upon this project as amended has been expended \$154,000, of which \$100,000 has been applied to maintenance in repeated dredging of the cut across the bar at the mouth of the river. The channel through Bulkhead shoal, dredged in 1891-92, remains practically unchanged, with a minimum depth of 8 feet at mean low water.

Prior to the adoption of any project of record in this office \$28,600 was expended on this improvement, 1833-1839, but the object and results of such expenditures are unknown.

The existing project, approved by act of March 3, 1899, provides for a channel 100 feet wide, 18 feet deep at mean low water through the West Pass, along the northern shore of St. George Island, and across the bay to the water front of Apalachicola, estimated to cost \$350,000, and \$20,000 or \$30,000 annually for maintenance of completed work. See Annual Report of the Chief of Engineers for 1897, pages 1655-1659, giving report of survey, printed in House Document No. 129, Fifty-fourth Congress, second session, upon which the above project was based.

Under an appropriation of \$20,000, made by the act of March 3, 1899, a contract was entered into on December 16, 1899, for dredging a channel 18 feet deep at mean low water through the West Pass entrance and the Link channel, along the north shore of St. George Island, to St. George anchorage. Work under this contract was

commenced March 28, 1900, and suspended May 12, 1900, due to the expenditure of the funds available. The dredging done secured a channel 17 feet deep, 150 feet wide, and 5,280 feet long over the bar at West Pass entrance, but no work was done on the Link channel. Since the execution of this work West Pass has been shoaling rapidly, particularly at the outer crest of the bar, the available depth on this crest at mean low water at the end of the fiscal year not exceeding 13 feet.

From an appropriation of \$40,000, made available by the act of June 13, 1902, \$20,000 was allotted for dredging on the bar at the mouth of the river, which had been gradually shoaling since the last dredging was done, in 1897. Work was commenced November 13, 1902, and continued until February 17, 1903, when a channel 80 feet wide, with a minimum depth of 9 feet at mean low water, had been secured from a point 1,047 feet south of the Red Beacon to deep water in the river. With the balance of this allotment a channel 567 feet long was also dredged 80 feet wide and 9 feet deep through the "Oyster Lump" south of the Red Beacon, on the line marked by St. George Island light.

The ordinary range of the tide is about 2 feet.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, was \$40,443.55, of which about \$20,000 was for maintenance. Effort was made to let a contract for work on the West Pass and Link channel, but no favorable bid was received.

The commerce of this port is in timber, cotton, naval stores, staves, a large quantity of dressed and kiln-dried lumber, shingles, laths, and miscellaneous freight.

July 1, 1902, balance unexpended	\$40,000.00
June 30, 1903, amount expended during fiscal year	20,443.55
July 1, 1903, balance unexpended	19,556.45
July 1, 1903, outstanding liabilities	14.80
July 1, 1903, balance available	19,541.65
{ Amount (estimated) required for completion of existing project	330,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	110,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 2.)

3. *Apalachicola River, the Cut-off, and lower Chipola River, Florida.*—The Apalachicola River, from the junction of the Chattahoochee and Flint rivers to the Gulf of Mexico (Apalachicola Bay), has a length of about 137 miles, and a low-water slope of about 3 inches to the mile. The width varies from 150 to 300 yards, and the available depth was originally 6 feet at low water, except where obstructed by snags and sunken logs.

The Confederate authorities obstructed the channel at a point about 47 miles above the mouth, causing the river to break through by a channel known as Moccasin Slough into the River Styx, the latter a tributary entering the Apalachicola a few miles below the Confeder-

ate obstructions. Moccasin Slough was very narrow and tortuous and much obstructed by logs, snags, etc., and the former channel has gradually filled up.

About 55 miles above the mouth steamboats may leave the river, and after passing through the Cut-off, lower Chipola River, and Lee Slough reenter it about 17 miles farther down, thus making many landings of much greater importance than those upon the corresponding part of the main river, which includes Moccasin Slough, above mentioned.

The original project, approved by the act of June 3, 1874, contemplated securing a channel 100 feet wide and 6 feet deep at low water by the removal of snags and overhanging trees, and widening and straightening Moccasin Slough and the Elbows, at an estimated cost of \$80,333.

The act of September 19, 1890, adopted of an addition to the project involving the clearing of a channel 60 feet wide and 5 feet deep through the Cut-off, Lee Slough, and the lower Chipola River at a cost of \$7,500.

The amount expended on work under this project since 1874 to the close of the fiscal year ending June 30, 1903, was \$65,842.24. In addition, there was expended between 1828 and 1831, \$13,000, for which no project is of record. These expenditures have improved Moccasin Slough sufficiently for present purposes and maintained the river reasonably free from snags and other obstructions and enabled steamboats to make use of the Cut-off, lower Chipola River, and Lee Slough, either by day or night. An available depth of 6 feet has been secured in the Apalachicola River, and 5 feet in the Cut-off, lower Chipola River, and Lee Slough. The Cut-off and Lee Slough have been widened also at the narrowest places, enabling steamboats to pass through safely going downstream, but the channel is still very crooked and the bends so sharp that navigation is not attempted upstream, the steamboats confining themselves to the main river on the trip up.

The work was done with the plant belonging to the Chattahoochee and Flint rivers improvements, and comprised cutting overhanging timber, removing snags and logs, blasting out cypress stumps, and widening the slough and Cut-off by clearing the points of timber and dredging them into the channel for the current to deposit in the deep holes.

Variation of the water level surface is from 0.0 to 30 feet at Chattahoochee River bridge.

This river is navigable throughout its entire length.

As the country bordering on the Apalachicola River is almost entirely dependent upon the river for the transportation of its supplies and products, this improvement is essential to the development of the country.

The commerce of the river consists chiefly of cotton, naval stores, general merchandise, saw logs, and timber for export, and is so combined with that of the Chattahoochee, Flint, and upper Chipola rivers that a separation is impossible. The commerce of all these streams amounted to about \$2,000,000 in 1898; about \$4,000,000 in 1899; about \$4,777,000 in 1900; about \$11,000,000 in 1901; about \$11,500,000 in 1902, and about \$13,324,000 in 1903.

For detailed statistics, see report upon Flint and Chipola rivers.

July 1, 1902, balance unexpended	\$6,000.00
June 30, 1903, amount expended during fiscal year	1,842.24
July 1, 1903, balance unexpended	4,157.76
{ Amount (estimated) required for completion of existing project	15,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 3.)

4. *Upper Chipola River, Florida, from Marianna to its mouth.*—The river from Marianna to the head of the Dead Lakes has a general low-water depth of 5 feet and width varying from 60 to 200 feet, but is greatly obstructed by rock shoals, snags, and overhanging trees. Three bridges also form obstructions, their headways above low water being 17, 16, and 15 feet, respectively.

At "Look and Tremble" shoal, about 20 miles above the Dead Lakes, there is a fall of 5 feet in 40 over rock bottom. Between this shoal and the Dead Lakes there is a long, flat mud bar, at Sister Islands, over which but 2 feet can be carried at low water. The channel through the Dead Lakes, which is considered part of this improvement, has plenty of water, but is obstructed by snags and large cypress stumps and trees.

No funds were available for the improvement of this stream until an appropriation of \$5,000 was made by the act of March 3, 1899, to be expended in accordance with the approved project. This project provides for clearing a low-water channel 3 feet deep and 60 feet wide from Marianna to the foot of the Dead Lakes, estimated to cost \$41,000, exclusive of necessary plant, which would comprise a snag boat, drilling barge, and dump scow. (See Annual Report of the Chief of Engineers for 1889, p. 1417.)

The amount expended to June 30, 1903, was \$5,000, with which snags, logs, and overhanging trees were removed and a channel blasted through the rock reefs from Marianna to "Look and Tremble" shoal. Wing dams were built below some of the shoals to raise the water level on the shoals, and below "Look and Tremble" shoal, down as far as Sister Islands, snags, logs, and overhanging timber were removed until the appropriation was exhausted. Very little benefit has been derived from the expenditure above "Look and Tremble" shoal, except to the timber industry, but the work done below the shoal has been of great benefit, as there are about a dozen turpentine stills below this shoal and a considerable commerce on this portion of the river.

The variation of the water level is 0.0 to 14 feet. Two feet is the maximum draft at low water over the shoalest part of the river below the shoal "Look and Tremble."

Nothing has been done during the past fiscal year. The river is still obstructed by shoals at Sister Islands, "Look and Tremble," and at numerous points above, as well as by the bridges mentioned. The channel below Sister Islands is much obstructed by snags and logs, and this same condition exists in the channel through the Dead Lakes, which must be used for 20 miles on the way to the Apalachicola River, via the Cut-off and lower Chipola River and Lee Slough.

The commerce of this stream consists principally of naval stores,

round and square timber, lumber, and other miscellaneous freights, the estimated value of which was, on June 30, 1903, \$637,000.

The section of the country through which this stream flows is heavily timbered with long-leaf yellow pine and cypress, which is now being rafted down this stream in large quantities. The total value of this traffic is not known, but it is included in the valuation of timber and lumber exports for Apalachicola Bay and Carrabelle Harbor, Florida.

July 1, 1902, balance unexpended	\$2,000.00
July 1, 1903, balance unexpended	2,000.00

{ Amount (estimated) required for completion of existing project	34,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	2,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S 4.)

5. *Flint River, Georgia*.—Originally this river was navigable at low water from its mouth to Bainbridge, a distance of 36 miles, for boats drawing 3 feet, but the channel was narrow, crooked, and greatly obstructed by logs, snags, and overhanging trees. Above Bainbridge the channel was so obstructed by rock shoals, loose rock, and bowlders that there was no navigation except on a rise of 5 feet, when steamboats could run to Albany, 105 miles above the mouth. Above Albany to Montezuma, 182 miles from the mouth, the channel was so obstructed by sand and rock shoals, bowlders, snags, logs, and overhanging trees that the river was not navigable at a low-water stage.

The original project called for a channel 100 feet wide and 3 feet deep at extreme low water from the mouth of the river to Albany, Ga., at an estimated cost of \$184,862.

This project was extended in 1870 to give a channel for light-draft steamers at moderate stages of water from Albany to Montezuma by the removal of logs, snags, and overhanging trees, cutting through rock reefs, and deepening sand bars by contraction works, at an additional cost of \$15,000.

The amount expended up to the close of the fiscal year ending June 30, 1903, was \$214,971.38. As a result of the work done, the river is now navigable throughout the year from Albany down to Newton, 33½ miles, and from Bainbridge to the mouth, 36 miles, there being a good channel, with 3 feet available at low water, throughout these sections.

Between Bainbridge and Newton, 35½ miles, the river is not navigable below a 5-foot stage of water, and the channel is still much obstructed by logs, snags, bowlders, and rock reefs. Considerable work has been done between these points, and, on a slight rise, boats are able to go up as high as Chevertown, 20 miles above Bainbridge. When the improvement of this section has been completed, the river will be open to navigation at low water from its mouth to Albany, Ga.

The section between Albany and Montezuma, 77 miles, is still much obstructed, although it has been repeatedly cleared of snags and similar obstructions, in accordance with the project. As there is no navigation on this part of the river, it is recommended that no further work be done on this section until the improvement of the section between Bainbridge and Newton renders work already done fully available.

A small amount of work was done on this improvement during the past fiscal year between Bainbridge and Newton.

The water level varies from 0.0 to 40 feet.

During low water Bainbridge, Ga., is the head of navigation, but for about nine months of the year the river has a stage of 5 feet or over, and small steamers can go as far as Albany, Ga.

The commerce consists principally of cotton, naval stores, provisions, general merchandise, saw logs, and timber for export. Several very large sawmills are located at Bainbridge, but no record of the amount of lumber manufactured is kept, as shipments are made by rail. A large part of the saw logs used by these mills comes down the river.

To make the improvement above Newton fully available it will be necessary to remove the obstructions between Bainbridge and Newton, and the completion of this work, which is largely permanent rock work, will greatly benefit the section of country between Albany and the mouth of the river. There are a large number of turpentine stills in operation on the river, which depend upon the water transportation for their products and supplies.

The commerce of the lower part of this stream is so combined with that of the Chattahoochee and Apalachicola rivers that it is impossible to give a statement in regard to it. The commerce of that part below Albany, down as far as the improvement has been carried, is estimated to be 34,549 tons, valued at \$1,727,000 for the past fiscal year.

July 1, 1902, balance unexpended	\$25, 140. 51
June 30, 1903, amount expended during fiscal year	4, 111. 89
July 1, 1903, balance unexpended	21, 028. 62
July 1, 1903, outstanding liabilities	8, 583. 08
July 1, 1903, balance available	12, 445. 54
July 1, 1903, amount covered by uncompleted contracts	7, 460. 00
(Amount (estimated) required for completion of existing project	92, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	20, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 5.)

6. *Chattahoochee River, Georgia and Alabama, below Columbus.*—Columbus, Ga., is 223 miles above the junction of this river with the Flint, and 360 miles above the mouth of the Apalachicola River, formed by the confluence of the Chattahoochee and the Flint. Originally, boats were always able to reach Columbus, but navigation was difficult and dangerous by day and impossible by night, owing to the large accumulation of logs, snags, and overhanging trees, and to sand, rock, and marl shoals obstructing the channel.

The project for improvement, adopted in 1873, provided for a low-water channel 100 feet wide and 4 feet deep from Columbus, Ga., to Chattahoochee, Fla., at the junction of the Flint, which was to be obtained by the removal of logs, snags, and overhanging trees, cutting through the rock and marl shoals, and scouring out sand bars by works of contraction and shore protection. The estimated cost of this work from Chattahoochee, Fla., to Eufaula, Ala., 139 miles, was \$145,247, but no estimate of cost for that part between Eufaula, Ala., and Columbus, Ga., was ever made.

The amount expended on this work to the close of the fiscal year ending June 30, 1903, was \$381,329.96, largely expended in maintenance, removing the annual influx of obstructions brought in from caving banks.

No increased depth, as a whole, has been gained, but by removing the logs, snags, and overhanging trees, and removing the sand, gravel, marl, and rock reefs the river has been kept open to navigation. As nearly all the land along the banks of the river and its tributaries has been gradually cleared, each rainy season has brought increasing quantities of sand into the river, filling the original river bed with shifting sand and gravel bars, and greatly changing its regimen. At Columbus, where there was formerly 5 feet of water at the lower end of the wharf, the sand and gravel is now over the wharf. In fact this stream has now a changeable bed, and it is impossible to say one year exactly where work will be needed the next. Four feet draft can be carried at ordinary low water, but at extreme low water scant 3 feet is the maximum draft that can be counted upon.

Below Eufaula, Ala., the river is now in a fair condition, with an available low-water depth of 3½ feet, but between Eufaula and Columbus there are a number of bars and isolated obstructions which cause trouble, particularly at extreme low water. The most serious of these obstructions is a series of sand bars formed in the river from the wharves at Columbus, Ga., down to Mary Freemans bar, 3 miles below, which makes it impossible for steamboats to reach Columbus. The head of navigation during the period of extreme low water is therefore Mary Freemans bar.

During the past fiscal year snags and other obstructions were removed from the river throughout its length, and a jetty was built at Jenny Island. A large number of other sand bars and shoals between Columbus, Ga., and Eufaula, Ala., still needs similar improvement, and the wing dams and training walls already built require repairs and maintenance. In addition, the annual accumulations of snags and other obstructions must be removed from the river throughout its length.

The variation of the water level is from 0.0 to 47 feet at Columbus.

The commerce of this stream is so combined with that of the Flint and Apalachicola rivers that a separation is impossible. It is stated under the report of the Apalachicola River as being 120,738 tons, valued at \$11,500,000 in 1902, as against 140,976 tons, valued at \$12,687,000 in 1903.

July 1, 1902, balance unexpended	\$102,743.95
June 30, 1903, amount expended during fiscal year	28,793.13
July 1, 1903, balance unexpended	73,950.82
July 1, 1903, outstanding liabilities	43,238.91
July 1, 1903, balance available	30,711.91
July 1, 1903, amount covered by uncompleted contracts	41,200.00

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	75,000.00
	Submitted in compliance with the requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	(See Appendix S 6.)	

7. *Choctawhatchee River, Florida and Alabama.*—The Choctawhatchee River is 162 miles long from Newton, Ala., to its mouth, in Choctawhatchee Bay, an arm of the Gulf of Mexico. Hollis Bridge is 7 miles, Pate Landing 12 miles, Geneva 37 miles, and Caryville 62 miles below Newton.

Originally the channel was much obstructed by snags, logs, and sand and gravel bars.

The project for the improvement, as amended in 1890, contemplates the creation of a low-water navigable channel throughout, by removing logs, snags, and overhanging trees, by excavating rock and marl shoals, and by contraction works and shore protection.

The amount expended on this river under the existing project up to the close of the fiscal year ending June 30, 1903, was \$154,073.56, of which approximately one-half has been expended in maintenance.

The work done has secured a fairly navigable channel from Geneva to Caryville, with a low-water depth of 3½ feet. The channel between Pate Landing, on the upper portion of the river, and Geneva was also partially improved; and prior to the construction of the railroads, which touch the river at Newton and Geneva, and at a point between them, it was occasionally used by steamboats, but these have all been withdrawn.

From Geneva to the mouth of the Holmes River large quantities of saw logs and hewn timber are floated out, and below the mouth of Holmes River three steamboats navigate the river at present. To facilitate this commerce it is important that the channel be kept free of obstructions, and that the bar at the mouth of the river (Cypress Top), now being dredged to a depth of 5 feet, be further deepened to enable tugs to handle the timber brought down.

On December 10, 1900, the snag boat *Choctawhatchee* was snagged and sunk near Pate Landing and had to be rebuilt. A new hull for this boat was completed recently, the boiler and machinery installed, and the boat commenced work above Geneva on June 24, 1903.

The commerce on this stream is mainly saw logs, timber, naval stores, and general merchandise, the value of which for the fiscal year ending June 30, 1903, is estimated to be about \$1,500,000.

July 1, 1902, balance unexpended	\$16, 224. 23
June 30, 1903, amount expended during fiscal year	7, 296. 79
July 1, 1903, balance unexpended	8, 926. 44
July 1, 1903, outstanding liabilities	1, 768. 90
July 1, 1903, balance available	7, 157. 54

Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	8, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1890.	

(See Appendix S 7.)

8. *La Grange Bayou, Florida, including Holmes River, Florida, from Vernon to its mouth.*—Holmes River empties into the Choctawhatchee River about 40 miles above the mouth of the latter. It is a wide and deep stream to the town of Vernon, 25 miles above its mouth, but was originally obstructed by sunken logs, fallen timber, and overhanging trees, and was only available for navigation by small sailing craft and barges, which occasionally made trips up to Vernon.

The present project for the improvement of the stream provides for making a navigable channel by removing logs and snags from the river and overhanging trees from its banks from the mouth up to the town of Vernon.

The total amount expended on this improvement up to the close of the fiscal year ending June 30, 1903, was \$7,929.80, of which \$5,769 was upon Holmes River and \$2,160.80 upon La Grange Bayou, all of which was expended prior to June 30, 1902. This work cleared the channel of all obstructions that were then found and made it available for the small craft that used the stream. During the past year a considerable trade has sprung up on this river, and it is proposed to resume work during the fall of 1903 and clear the river of obstructions with the funds now available.

The commerce of the stream consists of cotton, turpentine, rosin, molasses, honey, and miscellaneous articles, which are carried by water to Pensacola to market.

July 1, 1902, balance unexpended	\$2, 070. 20
July 1, 1903, balance unexpended	2, 070. 20

(See Appendix S 8.)

9. *Harbor at Pensacola, Fla.*—The available depth across the inner bar at the entrance to this harbor in 1879, previous to any work of improvement, was 19.5 feet, the width of the channel being contracted by the encroachment of the Middle Ground shoal to the southward. The harbor entrance and channelway were also obstructed by wrecks, and the western shore line in the vicinity of Fort McRee was cutting away rapidly, almost the whole of the old Fort McRee washing away before the erosion was stopped.

The project of 1877 considered only the removal of the wrecks; that of 1878 called for the removal of these wrecks and for making a survey to determine further recommendations for improvement. The project of 1881 provided for dredging a channel 300 feet wide and 24 feet deep at mean low water for the temporary relief of navigation, and also for protecting the shore line near Fort McRee with a view to preventing further injurious changes. Dredging under this project was carried on at various times between 1881 and 1893, and at the close of the dredging operations in August, 1893, the available channel was 225 feet wide and 24 feet deep at mean low water. Two groins, one 360 feet and the other 220 feet long, were completed in 1890, and still serve to hold the shore line near Fort McRee.

In 1891 a special Board of Engineers presented a project for opening a new channel across the Caucus shoal, following the direction of the ebb current, by means of two jetties, assisted by dredging, if necessary. In 1895 a second special Board of Engineers recommended that no change be made in the project of 1891, but that dredging be tried, using one of the hydraulic dredges belonging to the United States to open up a channel 26 feet deep at mean low water and as wide as practicable on the line of deepest water across the Caucus shoal and approximately on the line of the axis of the jettied channel proposed by the Board of Engineers in 1891. In December, 1895, this channel was opened by the U. S. dredge *Gedney* to a width of 120 feet and depth of 24 feet at mean low water. It has a length of about 10,000 feet across Caucus shoal, and is now known as the Caucus channel.

In 1896 the same Board that recommended the first amendment to the project of 1891 submitted a second amendment providing for the

expenditure of all funds available in continuing the work of dredging across the Caucus shoal, and for building a dredge and opening the channel across the Caucus shoal 30 feet deep at mean low water to a width of at least 300 feet, with such side slopes as the material would assume if sufficient funds were made available by Congress. Until a channel should be opened by dredging across the Caucus shoal, as above proposed, the Board recommended that the construction of the jetties for its maintenance be not considered.

The river and harbor act of March 3, 1899, extended this project to "securing a channel depth of 30 feet at mean low water from the Gulf of Mexico to the dock line at the east end of the city of Pensacola."

With balance of funds left from the appropriation of March 3, 1899, and an allotment of \$5,000 from the emergency act of June 6, 1900, 184,753.8 cubic yards of material was removed during the fiscal year ending June 30, 1902, by the U. S. dredge *Comstock*, loaned from the Galveston district. This work restored the 30-foot depth for a width of 100 feet throughout the center of the channel and for an additional width of 100 feet a depth of 28 feet was obtained.

The amount expended on these projects was \$725,849.91. The work done comprises the removal of the wrecks obstructing the channel, dredging a large amount of material from the inner bar, opening and redredging a 30-foot channel across the Caucus shoal, and the protection of the shore line by the construction of two groins near old Fort McKee from erosion, which are still in good condition.

The river and harbor act approved June 13, 1902, appropriated \$220,000, of which \$150,000 might be used in constructing a seagoing suction dredge. This dredge is now building under the direction of Capt. J. C. Sanford, Corps of Engineers, and details of operations are given in Appendix I 6, herewith. The same act modified the project, which now involves dredging a channel 30 feet deep and 500 feet wide from the Gulf of Mexico to the dock line at the east end of the city of Pensacola.

From the sum last appropriated there has been expended, from moneys not required for the construction of the dredge, \$784.67, for examinations of the channel and the removal of the boathouse from the naval reservation.

During the fiscal year the channel has been shoaling gradually, and on June 30, 1903, the available depth at mean low water, as nearly as could be determined from examinations made, was about 29 feet, with an available width of 100 feet, and should no serious storms occur it is hoped that no dredging will be absolutely necessary until the dredge now under construction is ready for work. Provision should, however, be made for such dredging, and for the continuous operation of the dredge when completed.

The commerce of this port is very large. For the fiscal year ending June 30, 1899, the foreign and coastwise exports were reported as \$14,936,084; in 1900, as \$14,828,580; in 1901, as \$14,710,649; in 1902, as \$15,464,171, and in 1903, for foreign exports only, as \$13,741,540, no record of the coastwise exports being available.

During the past year the imports have increased from \$142,922 to \$1,033,891; the duties on imports from \$81,129.76 to \$186,252.63, and the amount of fees, dues, and duties paid the custom-house from \$22,238.27 to \$208,921.96.

July 1, 1902, balance unexpended.....	\$223, 661. 79
June 30, 1903, amount expended during fiscal year.....	^a 7, 440. 14
July 1, 1903, balance unexpended.....	216, 221. 65
July 1, 1903, outstanding liabilities.....	^b 102. 37
July 1, 1903, balance available.....	216, 119. 28
July 1, 1903, amount covered by uncompleted contracts.....	^c 150,000. 00
{ Amount (estimated) required for completion of existing project.....	310, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	100, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix S 9.)

10. *Escambia and Conecuh rivers, Florida and Alabama.*—These two names apply to one and the same stream, which flows through a heavily timbered country in southern Alabama and western Florida into Escambia Bay, an arm of Pensacola Bay. The timber from this district is brought down the river and forms a large part of all that exported from Pensacola. Originally the river was much obstructed by snags, marl reefs, and sand bars, and a bar prevented the entrance of tugs to the mouth of the river, where the rafts are made ready to be towed to Pensacola, and seriously interfered with navigation.

The first appropriation for the improvement of this river was made in 1833, and prior to the adoption of the present project \$5,000 was expended in removing obstructions. A subsequent appropriation of \$5,500, made in 1836, was returned to the surplus fund in 1838. No further appropriations were made until 1880.

The present project, adopted June 14, 1880, is based upon reports of the examinations and surveys printed in the Annual Report of the Chief of Engineers for 1879, pages 843–852, and provides for the improvement of the river from its mouth to Indian Creek, Alabama, an estimated distance of 293 miles, by the removal of snags, logs, and overhanging trees; by excavating rock shoals; by works of contraction and shore protection, and by dredging a channel through the bar at the mouth.

The amount expended to June 30, 1903, was \$102,785.69, largely for maintenance. This has kept the river fairly free from snags and opened the channel across the bar at the mouth from time to time, and has greatly facilitated the rafting and towing of timber.

Due to lack of funds, no work was done during the fiscal year ending June 30, 1902, and the channel, which at the suspension of active operations was in fair condition for rafting on stages of water slightly above low water, had again become badly obstructed by sunken logs and by large trees brought into the stream with the caving banks. A rise at least 3½ feet above low water was necessary for the safe transportation of timber rafts, and when work was resumed in September, 1902, 75 rafts were tied up at the mouth of Murder Creek alone, waiting for a rise in the river or for the removal of the obstructions by the snag boat. When funds were available for operating the snag boat during each low-water season, the river was kept in good condition and such delays were never experienced.

^a Includes \$2, 928. 44 on account of dredge construction.

^b Includes \$100. 62 on account of dredge construction.

^c On account of dredge construction.

From September 1, 1902, to December 15, 1902, work was confined to the portions of the river most obstructed. About 44 miles was gone over, and conditions were much improved on that part of the river; but, due to the great length of stream which could not be touched, the general condition is still unsatisfactory. Rafting can, however, be carried on during low water on that portion of the river recently improved.

The commerce of this stream is mainly in timber, lumber, and saw logs, valued at about \$1,350,000.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	3,785.69
July 1, 1903, balance unexpended	1,214.31
July 1, 1903, outstanding liabilities	4.50
July 1, 1903, balance available	<u>1,209.81</u>

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 10.)

11. *Alabama River, Alabama.*—This river is formed by the junction of the Coosa and the Tallapoosa, 11 miles below Wetumka on the Coosa River, and from this junction to its junction with the Tombigbee to form the Mobile it constitutes a 312-mile link in a waterway 815 miles long, from the Oostenaula and Coosawattee rivers, Georgia, to the Gulf of Mexico.

The river was originally so obstructed by logs, snags, and overhanging trees, and shoals, many with depths of but 2.5 feet, that navigation was practicable by day only during the low-water season. Long detentions were frequent at many of the shoals below Selma; and when the water was unusually low, traffic was suspended between Selma and Montgomery.

The original project, adopted in 1878, for the improvement of this stream (see Report of the Chief of Engineers for 1876, Part I, p. 498) contemplates obtaining a channel 4 feet deep at low water, with a minimum width of 200 feet. This result was to be obtained by removing logs and snags from the channel and overhanging trees from the banks, by cutting through rock reefs and gravel bars, by blasting and dredging, by deepening the channel across sand shoals and bars by works of contraction, and by stopping the caving and washing of the banks by shore protection, all at an estimated cost of \$229,741.

The project was amended in 1891 to provide for a low-water channel 6 feet in depth, to be secured by means of the removal of snags and overhanging trees, contraction works, blasting, dredging, and shore protection, the object being to secure increased safety to navigation, greater regularity and reduction in time of trips, and to enable steamboats to carry greater loads.

The estimate submitted in 1891 was \$386,251 and was based upon an assumption that \$100,000 should be provided annually. Ten thousand dollars annually was the estimate for maintenance, including snagging.

The amount expended on the original project was \$185,000, and on the amended project to June 30, 1903, was \$215,271.15. A large part of these expenditures has been for maintenance, but they have nevertheless resulted in keeping the river open to navigation during the

entire year. The contraction works built in 1878, 1883, 1892, and 1894 have given such satisfactory results that no especial difficulty is anticipated in securing the low-water depth contemplated in the project, provided sufficiently large appropriations are made to employ an efficient plant and prosecute the work vigorously during each low-water season.

The survey authorized by the river and harbor act approved June 13, 1902, will be made during the coming low-water season. It is expected that report thereon will be submitted to Congress during its next session.

The maximum draft that could be carried through the channel at low water June 30, 1903, was 3 feet.

Variation of the water level is from 0.0 to 59 feet at Montgomery, Ala.

The commerce of this stream is important, consisting principally of cotton, cotton seed, fertilizer, grain, lumber, shingles, naval stores, staves, and a large quantity of miscellaneous freight of all descriptions, estimated for the past fiscal year as 145,448 tons, valued at \$13,680,000.

July 1, 1902, balance unexpended	\$22,286.97
June 30, 1903, amount expended during fiscal year	7,558.12
July 1, 1903, balance unexpended	14,728.85
July 1, 1903, outstanding liabilities	1,148.66
July 1, 1903, balance available	13,580.19
{ Amount (estimated) required for completion of existing project	176,251.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	35,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 11.)

12. Coosa, Oostenaula, and Coosawattee rivers, Georgia and Alabama.—The Coosa is formed at Rome, Ga., by the junction of the Oostenaula and Etowah rivers, which have their sources in northern Georgia. The Oostenaula is formed by the junction of the Coosawattee and Connesauga rivers, 56 miles northwest of Rome. The Oostenaula above Rome, Ga., and its tributary, the Coosawattee, are navigable for light-draft boats during nine months of the year for a distance of about 105 miles, but the Etowah and the Connesauga are not navigable.

The Coosa River has always been navigable for light-draft boats from Rome, Ga., to Greensport, Ala., an estimated distance of 162 miles, and this part of the river is of such a character as to make its improvement by works of contraction and channel excavation entirely practicable.

From Greensport, Ala., to Wetumka, Ala., a distance of 142 miles, to provide for navigation requires the building of locks and dams, in conjunction with works of contraction and channel excavation.

From Wetumka to the junction of the Tallapoosa River the river is navigable at all seasons.

The survey of Coosa River authorized by the river and harbor act approved June 13, 1902, will be made during the coming low-water season. It is expected that report thereon will be submitted to Congress during its next session.

(a) *Coosa River between Rome, Ga., and East Tennessee, Virginia, and Georgia Railroad bridge.*—The original project for the improvement of the Coosa River contemplated the opening of a continuous water route of transportation from the Mississippi River to the Atlantic Ocean by way of the Ohio, Tennessee, Coosa, Etowah, Ocmulgee, and Altamaha rivers, with canals from the Tennessee to the Coosa and from the Etowah to the Ocmulgee. This was designated as the "Southern route." The low-water depth and width of the channel proposed can not be stated from the records at hand.

Various examinations and estimates for the improvement of parts of this section of river have been made from time to time up to the adoption of the existing project September 19, 1890. This project, as modified by act of Congress of July 13, 1892, provides for a lock 200 by 32 feet and a 3-foot lift, with excavation for a 4-foot channel between Rome, Ga., and Wills Creek in Alabama, at a total estimated cost of \$180,000; for three locks between Greensport and Lock No. 4 (Whisenant and Ten Island shoals) 210 feet long, 40 feet wide, and an extreme low-water depth of 4 feet on miter sills, together with a 3-foot channel between Locks Nos. 1 and 3, at a total estimated cost, including accessory dams and dikes, of \$155,616.23; for five locks and dams from and including Lock No. 4, to the East Tennessee, Virginia, and Georgia Railroad bridge, the locks to have an available length of 280 feet, width of 52 feet, and an extreme low-water depth of 6 feet over the miter sills, together with a connecting channel 100 feet wide and 4 feet deep at extreme low water, at a total estimated cost of \$1,160,491, or at a total cost for the entire improvement of \$1,496,107.23.

To June 30, 1903, there has been expended on this section of the Coosa \$995,436.73, of which \$471,736.73 has been expended upon the existing project and \$523,700 prior to its adoption. The work accomplished is as follows:

Locks 1, 2, and 3, Coosa River, commenced prior to 1890, have been completed. They are situated, respectively, 0.68 mile, 3.86 miles, and 5.24 miles below Greensport, Ala., and have available lengths of 175 feet and widths of 40 feet.

Lock No. 4 (25.89 miles below Greensport), commenced since the adoption of larger dimensions above mentioned, has, together with its appurtenances, been under construction, with desultory appropriations, since 1886, but is still incomplete.

Channel improvement has been extended as far down as Lock No. 4, and navigation is now possible to this point except at extreme low water, when interruptions occur a short distance above Lock No. 4.

Owing to the small balance available nothing was done during the past fiscal year except maintenance of existing structures and care of the large amount of plant on hand.

Even if it be decided as the result of the survey and examination recently authorized by Congress to abandon the improvement of the river between Wetumka and the East Tennessee, Virginia and Georgia Railroad bridge, Lock No. 4 should be completed and a dam constructed at the site of Lock No. 5 to extend navigation to the railroads at Riverside and Coosa Valley, and as all the plant is in place and rapidly deteriorating this should be done at once.

On June 30, 1903, the maximum draft that could be carried at low water between Rome, Ga., and Lock No. 4 was 3 feet.

The commerce of this portion of the Coosa consists principally of

cotton, cotton seed, fertilizer, timber, lumber, staves, grain, and miscellaneous articles.

(b) *Coosa River between Wetumka and East Tennessee, Virginia and Georgia Railroad bridge.*—On account of the numerous rapids this part of the river has never been navigable.

The original project for the improvement of this section of the river, adopted September 19, 1890, as the result of a survey made in 1889, and modified by Congress July 13, 1892, contemplates slack-water navigation and provides for the construction of 23 locks and dams of varying lifts, of an available length of 280 feet and width of 52 feet, with 6 feet over the miter sills, no lift of lock to exceed 15 feet. In addition the channel is to be cleared of various rock reefs and points, so as to give a least depth of 4 feet, all at an estimated cost of \$5,106,422. There has been expended on this project to June 30, 1903, \$387,292.88, which has resulted in the construction of the lowest lock of the series, known as No. 31, excepting the dam and gates, the excavation of the channel between this lock and one next above, and the preparation of data and plans for the other locks and dams. As yet no benefit has been derived from this improvement, and its value is entirely dependent on the completion of the entire project.

Congress, by act of June 13, 1902, provided for an examination and survey, with the view to determining the cost and advisability of completing this improvement, and report upon this subject will be submitted during the coming fiscal year.

(c) *Oostenaula and Coosawattee rivers, Georgia.*—The Oostenaula and Coosawattee rivers have their sources in the mountains of northeastern Georgia and are tributaries of the Coosa.

From Rome to Carters Mill these rivers were originally obstructed by gravel bars, rock reefs, snags, and overhanging trees. Examinations were made in 1872 and 1874, and the original project, based upon them, was to secure 3-foot depth of channel on the Oostenaula and 24 inches of water on the Coosawattee to Carters Mill during nine months of the year, at an estimated cost of \$28,208.50.

There was expended on this project \$24,858.14, which in 1881 had practically completed it as intended, and no work has been done upon either river since that time.

The navigation is at present obstructed at high water by numerous closed bridges and at ordinary stages by sunken logs, trees, and snags; by overhanging trees; by various fish traps, erected under the laws of the State of Georgia, which require an opening of but 40 feet to permit the passage of boats; by the remains of two or three old milldams which have been only partly removed, and by detached masses of rock lying in the channel, which are especially dangerous in the short turns.

The navigation during the low-water season is still further obstructed by a number of gravel bars and two or three rock bars or reefs.

Mr. J. D. Kirkpatrick, president of the Georgia and Alabama Steamboat Company, reports that his boats "have been unable to operate these rivers regularly for the past year on account of the very bad condition of the dams, overhanging timber," etc.

The existing project is that part of the river and harbor act approved June 13, 1902, applying to these rivers, and is as follows:

Improving Coosa River, Georgia and Alabama, and the Oostenaula and Coosawattee rivers, Georgia, thirty-five thousand dollars, of which amount ten thousand dollars, or so much thereof as may be necessary, shall be expended upon the last-named rivers. * * *

No estimate of cost other than that quoted from the river and harbor act above was made.

The sum appropriated, or so much as may be necessary, will be expended during the ensuing fiscal year in renewing the works of contraction, removing snags and other obstructions from the channel, and cutting overhanging trees from the banks where they obstruct navigation. The sum expended during the past year amounted to \$77.08.

The appropriation was too small to justify the Government in acquiring a plant for this work. Every effort to hire one for the last season's operations failed, and therefore no work was done. Negotiations are now in progress for the hire of a suitable plant for this season's operations, and if these are successful, as expected, the improvement will be commenced at an early date.

Carters, on the Coosawattee, an estimated distance above Rome of 105 miles, is the head of navigation on this system of rivers.

July 1, 1902, balance unexpended	\$80, 675. 64
June 30, 1903, amount expended during fiscal year	13, 459. 93
July 1, 1903, balance unexpended	47, 215. 71
July 1, 1903, outstanding liabilities	3, 770. 25
July 1, 1903, balance available	43, 445. 46

(Amount (estimated) required for completion of existing project	6, 059, 913. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.	^a 125, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S 12.)

13. *Operating and care of canals and other works of navigation on Coosa River, Georgia and Alabama.*—The expenses of operating and care of Locks Nos. 1, 2, and 3, and the improved channel as far down as Dam No. 4, during the fiscal year ending June 30, 1903, amounting to \$22,638.72, exclusive of outstanding liabilities (\$154.25) on June 30, 1903, have been paid from the permanent indefinite appropriation provided by section 4 of the act of July 5, 1884.

(See Appendix S 13.)

14. *Removing sunken vessels or craft obstructing or endangering navigation.*—The steamer *C. Emlin*, which was burned and sunk in the channel opposite the town of Apalachicola, Fla., having been reported as an obstruction to navigation, with the approval of the Secretary of War, notice was sent the owners to remove the same, and they reported that they wished to do. Subsequently they reported, under date of June 29, 1903, that they had removed the machinery and abandoned that portion of the vessel which remains. The removal of this obstruction will therefore be undertaken as soon as a contract, after advertisement, can be made.

(See Appendix S 14.)

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN ALABAMA AND EASTERN MISSISSIPPI.

This district was in the charge of Capt. Spencer Cosby, Corps of Engineers, to March 14, 1903, and of Capt. W. E. Craighill, Corps of

^a For Coosa River between Rome and the railroad bridge.

Engineers, since that date. Division Engineer, Lieut. Col. H. M. Adams, Corps of Engineers.

1. *Mobile Harbor, Alabama.*—This channel originally had minimum depths of 5½ feet through Choctaw Pass and 8 feet through Dog River bar.

The improvement of the channel of Mobile Harbor has been progressive. Between 1826, the date of the first appropriation for this work, and 1857 a channel 10 feet deep was dredged through the shoals in Mobile Bay up to the city of Mobile. Between 1870 and 1876 this depth was increased to 13 feet, the channel being dredged to a width of 300 feet through Choctaw Pass and 200 feet through Dog River bar.

In 1880 a project for a channel 17 feet deep and 200 feet wide was adopted, and appropriations between 1878 and 1886 were applied to the formation of a channel of these dimensions.

In the river and harbor act of August 11, 1888, a project for securing a channel 23 feet deep was adopted, this project being modified by the river and harbor act of September 19, 1890, so as to provide for the formation of a channel 23 feet deep and with a top width of 280 feet from the Gulf of Mexico to the mouth of Chickasaw Creek, above the city of Mobile. This channel was completed in 1896, subsequent appropriations, up to and including that made by the sundry civil act of July 1, 1898, having been applied to its maintenance.

The total amount expended on these projects was \$3,648,630.68, of which about \$115,000 is estimated to have been applied to maintenance.

The existing project for the improvement of Mobile Harbor provides for the formation of a channel 23 feet deep and 100 feet wide at bottom, with appropriate slopes, from the entrance of the bay to the mouth of Chickasaw Creek, at an estimated cost of \$1,640,000; the formation of a channel 30 feet deep and 300 feet wide through the outer bar near Fort Morgan, at an estimated cost of \$91,250, and the removal of obstructions from Mobile Harbor at such times as the latter work may be authorized. This project was adopted by the river and harbor act approved March 3, 1899, and was modified by the act of June 13, 1902.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1903, is \$768,388.75, of which about \$54,547.98 has been applied to maintenance.

During the fiscal years 1900 and 1901 a channel 23 feet deep, from 40 to 200 feet wide, and with an aggregate length of 26.6 miles, was dredged in Mobile River and Bay under the existing project. This channel has subsequently shoaled to some extent.

During the fiscal year ending June 30, 1902, no funds were available for dredging, and expenditures were confined to the work of maintaining the channel by the removal of sunken logs, snags, and similar obstructions.

During the past fiscal year dredging operations were resumed on November 25, 1902, and are still in progress. Up to June 30, 1903, 2,409,939 cubic yards of material had been removed from the channel of Mobile Harbor under the existing contract, completing a cut in the river and upper bay 23 feet deep, from 100 to 150 feet wide, and with an aggregate length of about 15 miles. The work of removing from the channel sunken trees, logs, timbers, and other obstructions which were dangerous to navigation was prosecuted during March and

April, 1903. The work of dredging on the outer bar has not yet been commenced.

Expenditures during the past fiscal year have improved navigation conditions considerably as far as the work has been carried, but full benefits will not be derived until the completion of work under the existing contract for dredging in Mobile River and Bay, and until some work is accomplished in deepening the channel on the outer bar. On June 30, 1903, the minimum low-water depth within the limits of the present project was about 20 feet. As the bottom at the shoal points is comparatively soft, the maximum low-water draft that can be carried to Mobile is 21 feet. The average range of tide is about 14 feet.

With the balance of funds available from the appropriations of June 13, 1902, and March 3, 1903, it is proposed to continue operations toward enlarging the existing channel to the prescribed depth and width throughout the limits of the project; to undertake the work of removing deadheads, sunken logs, and other obstructions in Mobile River and Bay, and to commence the work of deepening and widening the channel through the outer bar near Fort Morgan.

The Mobile River is navigable for vessels of about 14 feet draft up as far as its head, which is about 43 miles above the city of Mobile.

Detailed information with reference to the work accomplished under the existing project is contained in the Annual Report of the Chief of Engineers for 1901, page 1810. The report of the survey upon which the project for Mobile Harbor is based is printed in House Document No. 199, Fifty-fourth Congress, first session, and in the Annual Report of the Chief of Engineers for 1896, page 1463. The report of the survey upon which the project for the improvement of the outer bar near Fort Morgan is based is printed in House Document No. 219, Fifty-sixth Congress, second session, and reprinted in the Annual Report of the Chief of Engineers for 1901, page 1854.

The imports and exports, foreign and domestic, for 1902 aggregated 1,746,219 tons; value, \$29,565,526.

July 1, 1902, balance unexpended	\$300,354.61
Amount appropriated by sundry civil act approved March 3, 1903	200,000.00
June 30, 1903, amount expended during fiscal year	500,354.61
July 1, 1903, balance unexpended	331,611.25
July 1, 1903, outstanding liabilities	67,906.29
July 1, 1903, balance available	263,704.96
July 1, 1903, amount covered by uncompleted contracts	173,475.00
(Amount (estimated) required for completion of existing project	641,250.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	350,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 1.)

2. *Black Warrior, Warrior, and Tombigbee rivers, Alabama.*—(a) *Black Warrior River.*—This name refers to that portion of the Warrior River above Tuscaloosa. Originally this part of the river was practically closed to navigation on account of shoals at and above Tuscaloosa.

The original project for the improvement was adopted in 1887, the object being to obtain a channel for barges of 6 feet draft at low water all the year round between Tuscaloosa and Daniels Creek, 14½ miles above, by means of five locks and dams, at an estimated cost of \$741,670.

The river and harbor act of March 3, 1899, provided for the construction of Lock 4, at a cost not to exceed \$190,500. As it was subsequently found that the lock could not be completed for the amount appropriated, the river and harbor act approved June 13, 1902, authorized the transfer of \$14,000 from the unexpended balance of the Warrior River appropriations for the completion of this lock. The same act extends the upper limit of the improvement to the junction of the Mulberry and Locust forks of the river, 46½ miles above Tuscaloosa, and provides for making a survey for the location of Locks 5 and 6 next above Lock 4. Report on this survey will be submitted to Congress during its next session.

Work so far done has been the completion of Locks 1, 2, and 3, the bulk of the masonry of Lock No. 4, the abutment and about 62 per cent of the dam. Six feet navigation can be carried 9 miles above Tuscaloosa to Lock No. 4. Beyond this there has been no improvement.

The total amount expended on the improvement to June 30, 1903, was \$752,069.93.

The improvement of the Black Warrior River between Tuscaloosa and Daniels Creek is based upon the report of a Board of Engineers, dated April 2, 1887, and published in the Annual Report of the Chief of Engineers for 1887, page 1302.

For commercial statistics, see report on operating and care of locks and dams on Black Warrior and Warrior rivers, Alabama.

(b) *Warrior River.*—This name refers to that portion of the Warrior River below Tuscaloosa. Originally logs, snags, and overhanging trees rendered navigation impossible at low water and dangerous on boating stages. The minimum depth of channel was about 1 foot and the minimum width about 60 feet.

The original project for the improvement, adopted by the river and harbor act approved March 3, 1875, contemplated deepening the channel by jetty construction and the removal of snags and overhanging trees. As appropriations were formerly made for the Warrior and Tombigbee rivers jointly, the amount expended on improvement of the Warrior River prior to the adoption of the present project is not known.

The present project, adopted by the river and harbor act of March 3, 1899, is for the construction of six locks and dams, with total lift of 60 feet, and is to afford a channel for barges of 6 feet draft at low water all the year round. The estimated cost of this work is \$1,534,000.

The act last mentioned provided for the construction of three of these locks and dams at a cost not exceeding \$660,000. On June 30, 1903, contract work on Lock 4 was 95 per cent completed. Contract work on Locks 5 and 6 was completed. Gates for Lock 5 are nearly erected, and the gates for Lock 4 are yet to be erected.

An account of this work may be found in the Annual Report of the Chief of Engineers for 1897, page 1679.

The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1890, page 1719.

The river and harbor act approved June 13, 1902, provided for the construction of locks and dams 1, 2, and 3 on this river at a cost not to exceed \$874,000; also that \$10,000 of this amount might be applied to the work of maintenance of the improvement between Tuscaloosa and Demopolis. Work on the lock was commenced under contract early in May, 1903, and considerable excavation and other work of a preliminary nature has been accomplished. A revised estimate by the local engineer officer of the cost of building these locks and dams is printed in House Document No. 165, Fifty-seventh Congress, first session, and in Annual Report of the Chief of Engineers for 1902, page 1293.

During May and June, 1903, the snag boat *Demopolis* removed logs, snags, and other obstructions from 14½ miles of Warrior River below Lock No. 4.

The amount expended on improvement of Warrior River under the existing project to June 30, 1903, was \$637,218.42, of which \$3,979.20 was applied to maintenance.

For commercial statistics, see report on operating and care of locks and dams, Black Warrior and Warrior rivers, Alabama.

(c) *Tombigbee River from the mouth to Demopolis (construction of locks and dams).*—The original condition of the navigable channel of this portion of the river was such as to permit of steamboat navigation during high stages of water only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth about 2 feet.

For project, amount expended, etc., see report on maintenance of channel of Tombigbee River from the mouth to Demopolis.

The amount expended on work of lock and dam construction under the existing project to June 30, 1903, was \$200,000, and the amount expended on a survey of this section of Tombigbee River, to determine the cost of completing Lock 1, the location and cost of Locks 2 and 3, and the amount and cost of necessary dredging in the river, to June 30, 1903, was \$6,116.72. This survey was authorized by act of June 13, 1902, and will soon be completed. Report thereon will be submitted to Congress during its next session. Lock No. 1, at McGrews shoals, Alabama, has been about two-thirds completed. The lock walls are built, but the gates are yet to be erected, the dam and abutment built, and the banks graded and riprapped.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685, and 1900, page 2202. The report of the survey upon which the existing project is based is printed in the Annual Report of the Chief of Engineers for 1890, page 1716.

For commerce on the river in 1902, see report on maintenance of channel of Tombigbee River from mouth to Demopolis.

July 1, 1902, balance unexpended	\$740, 483. 51
Amount appropriated by sundry civil act approved March 3, 1903.....	200, 000. 00
	940, 483. 51
June 30, 1903, amount expended during fiscal year	307, 638. 58
	632, 844. 93
July 1, 1903, balance unexpended	632, 844. 93
July 1, 1903, outstanding liabilities	34, 637. 00
	598, 207. 93
July 1, 1903, balance available	598, 207. 93
July 1, 1903, amount covered by uncompleted contracts	749, 033. 00
{ Amount (estimated) required for completion of existing project.....	^a 300, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	^b 550, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(d) *Tombigbee River, from the mouth to Demopolis (maintenance of channel).*—The original condition of the channel of this portion of the river was such as to permit of steamboat navigation during high-water stages only, lasting about six or eight months of the year. The minimum width of the channel was about 100 feet and the minimum depth 2 feet.

The original project for the improvement of this stream, as adopted in 1871, contemplated the removal of snags and other obstructions in the channel of the river, and the widening and deepening of the existing channel through various shoals, at an estimated cost of \$21,500. The project adopted in 1879 was to afford a channel of navigable width and 4 feet deep at ordinary low water from the mouth to Demopolis by the removal of snags, logs, and overhanging trees, and the improvement of the worst bars.

The amount expended on the improvement of this section of Tombigbee River under previous projects can not be given, as joint appropriations for the Warrior and Tombigbee rivers were made from 1875 to 1882, while between 1884 and 1888 the lower division of the river for which appropriations were made extended from Vienna to the mouth.

The earlier projects for the improvement of this section of Tombigbee River were superseded by the project adopted in the river and harbor act of September 19, 1890. The project adopted at that time provided for securing a channel 6 feet deep at low water between the mouth and Demopolis by the construction of locks and dams, bank revetments, and by the removal of logs, snags, and other obstructions. The cost of this project was originally estimated at \$508,808.98, but in 1897, after \$330,000 had been appropriated for the work, the estimate was increased, and the additional cost of completion was then placed at \$600,000.

By the river and harbor act of June 13, 1902, the formation of a 6-foot channel below Demopolis by constructing locks and dams was made a part of the project for securing 6-foot navigation in the Black Warrior, Warrior, and Tombigbee rivers, Alabama. Information in

^a The estimate for completion has reference only to construction of Locks and Dams Nos. 1, 2, and 3.

^b Of this amount, \$300,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

regard to work accomplished on the Tombigbee River under this project and the expenditures made in connection therewith will be found in the section of this report immediately preceeding (page 310).

Under previous projects this entire section of the Tombigbee River has been repeatedly cleared of snags, dikes have been constructed, dredging has been done at the worst bars, and the channel made navigable for steamboats at low stages of the river. The existing project for maintenance of the improvement of the Tombigbee River from the mouth to Demopolis was adopted by the river and harbor act of June 13, 1902, and contemplates the maintenance of the existing channel by the removal of logs, snags, and other obstructions from the stream, and by the repair of dikes.

The amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1903, was \$11,443.27, all of which was applied to maintenance.

During the past fiscal year, in addition to extensive repairs to working plant, snagging operations on this section of the river were prosecuted with funds appropriated by the act of June 13, 1902, from August 27 to December 15, 1902, and from June 1 to 30, 1903. During these operations a distance of 107 miles of river was placed in safe condition for navigation.

On June 30, 1903, snagging operations were still in progress, and the condition of the river was such as to permit of steamboat navigation on a 3½-foot rise above low water. Some troublesome obstructions still exist in the portions of the stream not recently worked over, and it is therefore proposed during the coming fiscal year to apply the available balance to the continuation of the work of removing obstructions.

The Tombigbee River is navigable for steamboats as far as Columbus, Miss., a distance of 341 miles above its mouth, and for rafts as far as Walkers Bridge, Miss., a further distance of 184 miles.

Detailed accounts of this improvement are contained in the Annual Reports of the Chief of Engineers for 1896, page 1437; 1897, page 1685, and 1900, page 2202.

Commerce on this section of the river in the calendar year 1902 aggregated 232,984 tons, valued at \$3,644,114.

July 1, 1902, balance unexpended	\$16,000.00
June 30, 1903, amount expended during fiscal year	11,443.27
July 1, 1903, balance unexpended	4,556.73
July 1, 1903, outstanding liabilities	787.00
July 1, 1903, balance available	3,769.73

Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	15,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(e) *Tombigbee River from Demopolis, Ala., to Columbus, Miss.*—The original condition of this section of the river was such as to admit of navigation only during high-water stages. The channel was obstructed by shoals, logs, and overhanging trees, the minimum depth of water being 1 foot and the minimum width of channel 70 feet. The improvement of the Tombigbee River between Demopolis and

Columbus was commenced under the project of 1871, which contemplated the improvement of this stream by the removal of snags and other obstructions in the river and the widening and deepening of existing channels through various bars. In 1879 this project was modified so as to provide for the formation of a channel of navigable width and 4 feet deep at low water from Demopolis to Columbus.

The earlier appropriations being made for the Warrior and Tombigbee rivers jointly, the exact amount expended on the original project for this improvement can not be stated.

The present project for the improvement of this section of the Tombigbee River provides for securing a channel 6 feet deep at low water from Demopolis to Columbus, a distance of 156 miles, by snagging, tree cutting, bank revetment, bar improvement, and the construction of locks and dams, at a cost originally estimated at \$779,400. In 1897 the construction of locks and dams was estimated to cost \$2,000,000. This project was adopted by the river and harbor act of September 19, 1890, but no provision has yet been made by Congress for commencing the work of lock and dam construction. The fall of the river from Columbus to Demopolis is about 108 feet.

The total amount expended on work under the existing project up to the close of the fiscal year ending June 30, 1903, was \$153,543.66, of which about \$53,086.77 was applied to maintenance. These expenditures have resulted in the formation of a clear channel within the limits of the project navigable for light-draft boats on a 2-foot rise above mean low water and in the partial maintenance of this improvement.

During the past fiscal year available funds were applied to the repair of plant and to the prosecution of snagging work. The portions of the river worked over and cleared of obstructions during these operations were a distance of 42½ miles above Demopolis, Ala., and 18 miles, from a point near Memphis, Ala., to above Pickensville, Ala.

On June 30, 1903, this section of Tombigbee River was navigable only on a 5 or 6 foot rise above low water, owing to obstructions which have lodged in the channel after winter freshets. With available funds it is proposed to restore as far as possible a clear low-water channel within the limits of the project.

The commerce on this section of the river for the calendar year 1902 amounted to 57,015 tons, valued at \$1,021,015.

July 1, 1902, balance unexpended	\$12, 543. 11
June 30, 1903, amount expended during fiscal year	6, 086. 77
July 1, 1903, balance unexpended	6, 456. 34
July 1, 1903, outstanding liabilities	564. 00
July 1, 1903, balance available	5, 892. 34

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(f) *Tombigbee River from Columbus to Walkers Bridge, Miss.*—Prior to 1902 this improvement was divided into two sections, one from Columbus to Fulton and the other from Fulton to Walkers Bridge, for which appropriations were made separately.

The original condition of the river was such that navigation was impossible except at high water, and difficult even at the latter stage,

owing to the logs, snags, and overhanging trees which obstructed the channel. The minimum depth in the channel was about 1 foot, and the minimum width was 50 feet.

The original and existing project for the improvement of the river above Columbus was adopted in 1873, and provided for obtaining a good high-water channel by the removal of obstructions, at an estimated cost of \$35,000. This project was completed in 1882, at a cost of \$27,293.65, since which time operations have been directed toward maintaining the improvement. The first specific appropriation for the portion of the river between Fulton and Columbus was made in 1892, this money, together with subsequent appropriations, being applied to the maintenance of a high-water channel. This portion of the river has been freed of snags and overhanging trees, and has been placed in a condition to permit of the passage of large rafts of logs and timber during high water.

The original and existing project for improvement of the river from Fulton to Walkers Bridge was adopted in 1888, and provides for securing a good high-water channel by removal of logs, snags, and overhanging trees, at an estimated cost of \$11,000, and for the maintenance of the same, at an annual cost of \$1,500. This project was adopted by the river and harbor act of August 11, 1888, and was completed in 1891, at a cost of \$6,517.19.

The total amount expended on these projects up to the close of the fiscal year ending June 30, 1903, was \$65,260.44, of which the sum of \$31,449.60 was applied to maintenance.

During the past fiscal year available funds have been applied to repairing and purchasing working plant and to the prosecution of snagging operations. The latter work was commenced on June 1, 1903, and was still in progress at the close of the fiscal year. As a result of such work a distance of 16 miles of river above Aberdeen, Miss., has been restored to its improved condition. With available funds it is proposed to continue work of removing obstructions from the channel of this stream within the limits of the project. This portion of the Tombigbee River is used only for rafting purposes, and on June 30, 1903, was in such condition as to permit of navigation on a 6-foot rise above low water, though the channel is very much obstructed, owing to caving banks, fallen trees, and obstructions which have lodged in the stream.

Reports on surveys upon which a portion of this project is based are printed in the Annual Reports of the Chief of Engineers for 1882, page 1312, and 1888, page 1226.

The commerce on this section of the river during the calendar year 1902 amounted to 225,000 tons, valued at \$450,000.

July 1, 1902, balance unexpended	\$4, 000. 00
June 30, 1903, amount expended during fiscal year	966. 79
July 1, 1903, balance unexpended	3, 033. 21
July 1, 1903, outstanding liabilities	410. 00
July 1, 1903, balance available	2, 623. 21
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	5, 000. 00

(See Appendix T 2.)

3. *Operating and care of locks and dams on Black Warrior and Warrior rivers, Alabama.*—(a) *Locks 1, 2, and 3, Black Warrior River.*—These locks and dams are near Tuscaloosa, Ala., and overcome the Tuscaloosa Falls with their combined lift of 29 feet. They were finished and opened to commerce in November, 1895, and on July 1, 1896, their operation and care became a charge under the general law of July 5, 1884.

During the fiscal year these locks have been operated and cared for by a lockmaster and two lockmen at each lock. In addition to their operation some repair work and dredging has been done and four new barges have been built. Total expense during the year for operating, repairs, etc., was \$16,250.58.

The commerce through the locks during the fiscal year ending June 30, 1903, amounted to 4,211 tons of coal, 2 tons steel rails, 13,096 tons stone, 2,001 tons sand, 590 tons logs, 313 tons lumber, 218 tons general merchandise.

(b) *Locks 5 and 6, Warrior River.*—Lock 5 is about 63 miles and Lock 6 about 46 miles by river below Tuscaloosa. Contract work on them was finished and the locks turned over to the United States in December, 1902. Lock 6 was opened for traffic in October, 1902, and has been used regularly since. Lock 5 has not been opened to traffic owing to failure to complete the erection of the gates before the winter floods set in. On January 1, 1903, the operation and care of these two locks became a charge under the general law of July 5, 1884.

Owing to the very soft character of the alluvial bed and banks of the stream, and to the violent character of the winter floods, extensive repairs have been necessary to the riprap bank protection, and a large quantity of stone has been placed below the dams to check erosion. The timber floor at Lock 5 has been damaged by upthrust, and the timber aprons below both dams have been considerably damaged by the action of heavy saw logs and drift below the dams. Preparations have been made to repair these damages and to place heavy stone aprons below the dams. Two new barges were built for the work, considerable new plant was purchased, and extensive repairs were made to old plant. Lumber for a new quarter boat was ordered. The total expense during the six months for operating, repairs, plant, etc., was \$27,446.75.

The commerce passing the locks during the six months ending June 30, 1903, amounted to 374 tons coal, 339 tons corn, oats, etc., 2 tons oil, 150 tons cotton, 11,182 tons stone, 15 tons scrap iron, 862 tons logs, 159 tons general merchandise.

(See Appendix T 3.)

4. *Pascagoula River, Mississippi.*—Before this improvement was commenced the channel through the bar at the mouth of the river had a least depth of 3 feet at low water, while inside the mouth for a distance of 10 miles upstream the river was navigable for vessels of 6½ feet draft. Appropriations for this work of improvement were made in 1827, 1828, and 1852, but there is no record of the work accomplished in these years.

The first extended project for the improvement of this stream was adopted in 1880 and contemplated securing a channel 7 feet deep and 200 feet wide across the bar at the mouth of the river. This project also included some snagging work on the river above Moss Point,

which is described in the report on the improvement of the Pascagoula River and its tributaries, the Chickasahay and Leaf rivers, Mississippi. The project for a 7-foot channel was practically completed in 1884, the total amount expended in securing such a channel, including the appropriations made between 1827 and 1852, amounting to \$74,500.

In 1886 a new project was adopted which provided for securing a channel 12 feet deep at low water with a navigable width between Mississippi Sound and Moss Point. Under this project a depth of 9 feet across the entrance bar was first obtained, while subsequently a channel 12 feet deep and 80 feet wide was dredged from Moss Point to the mouth of the river, and a 12-foot channel across the bar at the mouth was partially completed. These operations resulted in the expenditure of \$95,000, including the expenditure of about \$8,000 which was applied to dredging work in Horn Island Pass in 1897, or a total expenditure of \$169,500 under both projects. The present project for the improvement of Pascagoula River was adopted in the river and harbor act of March 3, 1899, and provided for the formation of a 12-foot channel from a point in Dog River three miles above its mouth, down the Pascagoula River to the 12-foot contour in Mississippi Sound, at an estimated cost of \$317,600, including the formation of a 20-foot channel through certain shoal spots in the Horn Island anchorage.

Work under this project was in progress between September, 1899, and February, 1902, during which time an uninterrupted 12-foot channel was obtained within the limits of the project in Pascagoula River, while a 20-foot channel was formed through the shoal areas in Horn Island anchorage.

The river and harbor act of June 13, 1902, modified and extended the existing project so as to provide for a channel 17 feet deep instead of 12 feet, from 3 miles above the mouth of Dog River to Mississippi Sound, at a total cost of \$1,050,222, exclusive of the Horn Island improvement and authorized the expenditure of \$150,000 for the commencement of operations under the modified project.

The total amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, was \$221,581.31, excluding the expenditure of about \$88,000 on the work performed at Horn Island. No portion of these expenditures has been applied to maintenance.

During the past fiscal year expenditures have been applied to the purchase of plant for inspection purposes and to the work of preparing for dredging operations. A contract for dredging has been entered into, under which the contractor expected to begin active operations in the early part of July, 1903. On June 30, 1903, the condition of the channel within the limits of the project permitted of its navigation at low water by vessels up to a draft of 11 feet.

The average range of tide at this locality is about 1½ feet.

The report of the survey of Pascagoula River upon which the existing project is based is printed in House Document No. 211, Fifty-fourth Congress, second session, and reprinted in the Annual Report of the Chief of Engineers for 1897, page 1718. The report of the survey of Horn Island Harbor is printed in House Document No. 51, Fifty-fifth Congress, third session, and reprinted in the Annual Report of the Chief of Engineers for 1899, page 1784. An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1899 and 1900, pages 1718 and 2211, respectively.

The commerce on the river for the calendar year 1902 amounted to 673,800 tons, valued at \$3,664,750.

July 1, 1902, balance unexpended	\$38, 235. 64
Amount appropriated by sundry civil act approved March 3, 1903	100, 000. 00
June 30, 1903, amount expended during fiscal year	138, 235. 64
	5, 216. 95
July 1, 1903, balance unexpended	133, 018. 69
July 1, 1903, amount covered by uncompleted contracts.....	140, 000. 00
{ Amount (estimated) required for completion of existing project	\$695, 622. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	\$225, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix T 4.)

5. *Pascagoula, Chickasahay, and Leaf rivers, Mississippi.*—(a) *Pascagoula River (above the mouth of Dog River).*—Before this improvement was commenced navigation was impossible on this section of Pascagoula River except during the periods of high water. The minimum width of the channel was 60 feet and the minimum depth was 1 foot, the stream being very much obstructed by snags and logs.

The first project for this improvement, which was adopted in 1880, in addition to providing for dredging work at the mouth of the stream, described in the report on the improvement of Pascagoula River, Mississippi, contemplated the improvement of the river by the removal of snags and overhanging trees. Under this project the river was cleared of obstructions between 1882 and 1884, at a cost of \$15,000.

In 1886 the existing project for this improvement was adopted. This project provides for the maintenance of the channel above the mouth of the river by the removal of obstructions from the stream from time to time. This project was modified in 1899, the extent of the improvement being limited at that time to the section of the river above the mouth of Dog River. The total amount which has been expended on the existing project to June 30, 1903, is \$19,160.88, all of which has been applied to maintenance.

From the combined appropriation of \$8,500 carried by the river and harbor act of June 13, 1902, for the improvement of Pascagoula River and its tributaries, the Chickasahay and Leaf Rivers, Mississippi, the sum of \$4,000 was allotted to the Pascagoula River and \$2,250 each to the other two streams. With these funds snagging operations were in progress on the Pascagoula River from October 1 to December 20, 1902, and from June 1 to 30, 1903. During this time the entire stream above the mouth of Dog River, a distance of about 100 miles, was worked over and placed in fair condition for rafting and light-

^a Balance necessary to complete appropriations to amount of \$1,050,222, the estimated cost of Pascagoula River project.....	\$657, 622
Amount diverted from appropriation of June 6, 1900, for completing improvement of Horn Island Harbor	38, 000

695, 622

^b Of this amount \$25,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902,

draft steamboat navigation. A portion of this allotment was used in the construction of a snag boat, which will be used in future years on this improvement. It is proposed to hold the balance of funds for future care and preservation of public property.

On June 30, 1903, the Pascagoula River was navigable at low water for vessels of 6½ feet draft as far up as Cedar Creek, a distance of 55 miles, while above this point, to the head of the river, light-draft navigation and rafting were possible on a slight rise above low water.

The commerce originating on Pascagoula River above the mouth of Dog River during the calendar year 1902 amounted to 120,550 tons, valued at \$813,400. In addition to this, the combined commerce of Chickasahay and Leaf rivers passed down this stream.

(b) *Chickasahay River*.—The original condition of this river was such that it was navigable only for small rafts during high water, and even navigation of this character was troublesome and dangerous. The minimum width of the channel was 50 feet and the minimum depth 6 inches, the river being badly obstructed with logs and snags. The original project for this improvement was adopted by the river and harbor act of September 19, 1890, and provided for obtaining a high-water channel from the mouth of the river up to Shubuta, Miss., a distance of 130 miles, by the removal of obstructions and overhanging trees. The river and harbor act of June 3, 1896, modified this project by limiting the improvement to that part of the river between the mouth and a point near Bucatunna, Miss., about 75 miles. The project further provided for the maintenance of the improved channel. The project as modified was completed in the latter part of 1896 at a cost of \$12,399.73, subsequent operations being for maintenance of the improvement. Operations in connection with this improvement were suspended in September, 1899, since which time a number of obstructions have lodged in the channel, so that on June 30, 1903, the river was only available for rafting on a 4 or 6 foot rise above low water.

The sum of \$2,250 was allotted for the improvement of Chickasahay River from the appropriation of \$8,500 for the Pascagoula, Chickasahay, and Leaf rivers, Mississippi, carried by the river and harbor act of June 13, 1902. Expenditures during the past fiscal year have been applied to the purchase of plant necessary for the prosecution of the work.

The total amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, was \$19,757.35, of which \$7,357.62 was applied to maintenance.

During the coming fiscal year it is proposed to apply available funds to the work of removing obstructions from the channel of Chickasahay River within the limits of the project. The Chickasahay River is used only for rafting purposes and for flatboats. For this class of navigation the stream can be used from the mouth up to Shubuta, Miss., 130 miles, on a 6 or 8 foot rise.

The report of the survey upon which the present project is based is printed in the Annual Report of the Chief of Engineers for 1889, page 1463.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

The commerce of the Chickasahay River during the calendar year 1902 amounted to 67,000 tons, valued at \$305,000.

(c) *Leaf River*.—Originally it was impracticable to navigate this river on account of the snags, logs, and overhanging trees obstructing the channel. The minimum width of the stream was 100 feet and the minimum depth $2\frac{1}{4}$ feet. The original project for this improvement was adopted in 1890, its purpose being to afford a channel for high-water navigation from Bowie Creek to the mouth of the river, a distance of 75 miles, by the removal of obstructions and overhanging trees. This project was completed in 1897 at a cost of \$11,019.04, since which time expenditures have been in the direction of maintaining the improvement.

The sum of \$2,250 was allotted for the improvement of Leaf River from the combined appropriation of \$8,500 carried by the river and harbor act of June 13, 1902, for the Pascagoula, Chickasahay, and Leaf rivers, Mississippi. During the past fiscal year with these funds the river between Beaumont, Miss., and the upper limit of the project at Bowie Creek, a distance of about 45 miles, was worked over and placed in good condition for rafting and light-draft navigation on a slight rise above low water.

The total amount expended on work under this project up to the close of the fiscal year ending June 30, 1903, was \$19,425.65, of which the sum of \$8,406.61 was applied to maintenance.

On June 30, 1903, the river within the limits of the project was available for rafting purposes on a slight rise above low water. The river is used to a very limited extent for any other form of navigation.

The report of the survey upon which the present project is based is contained in the Annual Report of the Chief of Engineers for 1889, page 1462, and an account of the improvement is contained in the Annual Reports of the Chief of Engineers for 1896 and 1900, pages 1453 and 2215, respectively.

The commerce of the Leaf River during the calendar year 1902 amounted to 206,000 tons, valued at \$635,100.

July 1, 1902, balance unexpended	\$8, 500. 00
June 30, 1903, amount expended during fiscal year	5, 343. 88
July 1, 1903, balance unexpended	3, 156. 12
July 1, 1903, outstanding liabilities	425. 00
July 1, 1903, balance available	2, 731. 12

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	4, 500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 5.)

6. *Harbor at Biloxi, Miss.*—This channel originally had a minimum depth of 4 feet. The original project for its improvement was adopted in 1882 and contemplated the formation of a channel through Deer Island flats to connect Biloxi Bay with the Back Bay of Biloxi at an estimated cost of \$35,000. The channel thus proposed was to have a depth of 8 feet at low water, with a width sufficient for navigation.

In 1884 this project was changed so as to provide for deepening the channel from Mississippi Sound to the wharves at Biloxi from the

existing depth of 4 to 4½ feet to 8 feet, the estimated cost of this work being \$55,000. The work of dredging under the project was commenced in September, 1887, and the project was completed in 1892, at a cost of \$34,148.64. The balance of funds available, to the extent of \$10,233.63, was subsequently applied to the work of removing shoals which had formed in the lower part of the dredged cut and to widening the channel to a slight extent. From an examination made in August, 1893, the channel was found to have a minimum width of 160 feet and a minimum depth of 9 feet. No work has been in progress in connection with this improvement since August, 1893.

The total amount expended on work in connection with the existing project to the close of the fiscal year ending June 30, 1903, was \$44,957.57. In January, 1896, the balance of \$617.73 was redeposited to the credit of the appropriation.

The river and harbor act approved June 13, 1902, appropriated \$10,000 for the work of improving Biloxi Harbor, Mississippi. During the past fiscal year a portion of this appropriation has been applied to the work of making a survey of the harbor and to necessary preparations for the performance of dredging work at this locality under contract. During the ensuing fiscal year it is proposed to apply available funds to the work of redredging the channel to a depth of 8 feet at low water and to as great a width as may be possible under a contract which was entered into in May, 1903. On June 30, 1903, the maximum low-water draft that could be carried through the dredged channel of Biloxi Harbor was 6½ feet. The average range of tide at this locality is 1½ feet.

The report of the preliminary examination of Biloxi Harbor is printed in the Annual Report of the Chief of Engineers for 1882, page 1322. An account of the improvement is contained in the Annual Report of the Chief of Engineers for 1893, page 1772.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

The commerce of Biloxi Harbor amounted to 45,700 tons, valued at \$1,391,400, exclusive of the lumber shipments from the harbor, for which accurate figures could not be obtained.

July 1, 1902, balance unexpended	\$10,000.00
June 30, 1903, amount expended during fiscal year	575.30
July 1, 1903, balance unexpended	9,424.70
July 1, 1903, amount covered by uncompleted contracts.....	8,195.00

Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	9,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 6.)

7. *Channel from Gulfport to Ship Island Harbor, Mississippi.*—Originally no channel existed between Ship Island Harbor and Gulfport, Miss. The depths on the site of the channel now in progress of

^a Erroneously reported last year as \$10,617.73.

formation ranged from 19 feet to 8½ feet, and the depths over the site of the proposed anchorage basin varied from 8½ feet to 2½ feet.

The existing project for this improvement was adopted by the river and harbor act of March 3, 1899, which authorized the Secretary of War to enter into a contract or contracts to dredge a channel 300 feet wide and 19 feet deep at mean low water from the anchorage basin at Ship Island Harbor, on the Gulf of Mexico, to Gulfport, Miss., and to construct at the end of this channel next to the shore an anchorage basin of similar depth and not less than 2,640 feet by 1,320 feet in area. This act also authorized the Secretary of War to contract for the maintenance of this channel and anchorage basin for a term of five years after their completion, for the sum of \$10,000 annually.

This work was first advertised in 1899, but no bids for its performance were then received. It was again advertised in January, 1901, and one bid was received, which was accepted. Under this proposal a contract was entered into, by the terms of which it was agreed by the contractor to dredge the channel and anchorage basin as called for by the project for the sum of \$150,000, work to be completed within two years from the date of commencement. Under the terms of this contract the maintenance of the channel and basin was required for the term of five years from the date of their completion, for the sum of \$10,000 annually.

Work under this contract was commenced on April 16, 1901, and has been continuously in progress since that time.

During the past fiscal year work has resulted in an increase in the dimensions of the channel, and on June 30, 1903, the depths in the channel and anchorage basin ranged from 15 to 25 feet, the maximum low-water draft available being 20½ feet. The average range of tide at this locality is about 1½ feet.

The sundry civil act approved June 28, 1902, appropriated \$150,000 for the payment of contract work at Gulfport, in accordance with the provision in the river and harbor act approved March 3, 1899, authorizing the execution of this work. These funds will be held until the completion of the channel and anchorage basin of the projected dimensions.

Since the commencement of operations at Gulfport, allotments amounting to \$16,685.04 have been made from the permanent indefinite appropriation carried by section 4 of the river and harbor act of July 5, 1884, for the purpose of superintending and inspecting operations on this work of improvement. Under these allotments the work has been surveyed and laid out, and the dumping of the material dredged under the contract has been supervised by inspectors appointed by this office. The expenditures to June 30, 1903, have amounted to \$10,781.27, all of which has been applied to inspection work.

A report of a survey of the channel from Ship Island Harbor to Gulfport, Miss., is printed in House Document No. 120, Fifty-fifth Congress, third session, and is reprinted in the Annual Report of the Chief of Engineers for 1899, page 1787.

During the calendar year 1902, 24,450 tons of timber, valued at \$203,750 was exported through the Gulfport channel, and imports amounting to 3,792 tons, valued at \$103,160, were received at this point.

July 1, 1902, balance unexpended	\$154,962.77
Amount allotted during fiscal year.....	^a 6,200.00
	161,162.77
June 30, 1903, amount expended during fiscal year	^a 5,259.00
	155,903.77
July 1, 1903, balance unexpended	155,903.77
July 1, 1903, outstanding liabilities	^a 300.77
	155,603.00
July 1, 1903, balance available	155,603.00
July 1, 1903, amount covered by uncompleted contracts.....	150,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	10,000.00

(See Appendix T 7.)

8. *Pearl River below Rockport, Miss.*—The limits of this improvement originally extended from the mouth of the river to Jackson, a distance of 313 miles. By act of Congress of April 21, 1900, the construction of a fixed highway bridge across Pearl River at Rockport was legalized, and this point thereby became the head of navigation for this section of Pearl River and the upper limit of the project. The distance from Jackson to Rockport is 67 miles.

Prior to improvement the condition of this river was such that it was not navigable except during high-water stages, and even then navigation was difficult and dangerous.

The original project for this improvement was adopted in 1880, and provided for a channel of navigable width and 5 feet deep at low water, by the removal of snags and sunken trees from the river bed and overhanging trees from the banks, at an estimated cost of \$95,940. This project having been found to be impracticable, a modified project was adopted in 1885 which provided for a 2-foot channel at low water throughout this section of the river at an estimated cost of \$145,940.

The total amount expended under this project and its modification up to the close of the fiscal year ending June 30, 1903, was \$158,613.82, of which about \$53,488.82 was applied to maintenance.

Owing to the fact that recent appropriations have been made for the improvement of the stream above the head of Holmes Bayou, the lower portions of the river have not been improved for quite a number of years, and on June 30, 1903, the lower section of the river, particularly in the vicinity of Holmes Bayou, was in such bad condition that steamboat navigation was impossible and the rafting of logs extremely difficult. In the upper sections of the stream steamboat navigation was possible on a slight rise above low water except for some distance below Rockport, where a 6 or 7 foot rise was necessary.

During the past fiscal year a portion of the appropriation of \$7,000 carried by the river and harbor act of June 13, 1902, was applied to the construction of a snag boat for the prosecution of operations on this stream. This snag boat was completed in March, 1903, and commenced operations on the Pearl River, about 18 miles above its mouth, on June 1, 1903. During the month of June the snag boat cleaned out the river for a distance of 15½ miles.

^a Permanent indefinite appropriation.

During the ensuing fiscal year it is proposed to continue snagging operations and to improve the sections of the river which at the present time are obstructed to the greatest extent by snags and fallen trees.

An account of the improvement is contained in the Annual Reports of the Chief of Engineers for 1897, page 1698, and for 1900, page 2218.

Commerce on this section of the river in the calendar year 1902 amounted to 202,000 tons, valued at \$550,000, which does not include manufactured lumber to the value of about \$600,000, which passes over portions of the stream not included in the present project.

July 1, 1902, balance unexpended	\$7,000.00
June 30, 1903, amount expended during fiscal year	3,488.82

July 1, 1903, balance unexpended	3,511.18
July 1, 1903, outstanding liabilities	474.00

July 1, 1903, balance available	3,037.18
---------------------------------------	----------

{ Amount (estimated) required for completion of existing project	33,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 8.)

9. *Pearl River between Edinburg and Jackson, Miss.*—The original condition of this section of the Pearl River was such that navigation was impossible except during high water, and even at high-water stages it was difficult and dangerous. The minimum width and depth of the channel were 40 feet and 1 foot, respectively, between Carthage and Jackson, while above Carthage the channel had a minimum width of 30 feet and a minimum depth of 3 inches. This portion of the Pearl River was formerly divided into two sections for which appropriations were made separately. The original project for the improvement of the lower section, from Carthage to Jackson, 105 miles, as adopted in 1879, contemplated obtaining a clear channel of navigable width and 5 feet deep at low water, at an estimated cost of \$21,000. In 1886 this project was modified so as to reduce the proposed depth of the channel to 2 feet, this being considered sufficient for the needs of navigation, and at the same time the estimate of cost was increased to \$50,000. Work under this project was completed in 1893 at a total cost of \$26,014.98, since which time funds have been applied to maintenance.

The original project for the section of the stream between Edinburg and Carthage, a distance of 25 miles, was adopted in 1884, and provided for the formation of a high-water channel for use during six or eight months of the year, at an estimated cost of \$13,464, and for the maintenance of this channel at an annual cost of \$500. Work under this project was completed in 1890 at a cost of \$5,857.08, subsequent appropriations having been applied to the work of maintenance.

Up to June 30, 1903, the total amount expended on the existing project for the Pearl River between Edinburg and Jackson was \$57,750.71, of which about \$25,878.65 had been applied to maintenance.

During the past fiscal year snagging operations were in progress between September 8 and December 31, 1902, a distance of 68 miles of river below Edinburg having been placed in a good condition for navigation on a slight rise above low water.

During the ensuing fiscal year it is proposed to apply the balance of available funds to the continuation of snagging operations on the lower half of this section of the Pearl River.

On June 30, 1903, the upper half of the stream, between Edinburg and Jackson, was in good condition for rafting or light-draft navigation, while the lower half, not having been worked over very recently, was still much obstructed by snags and logs.

Accounts of this work are contained in the Annual Reports of the Chief of Engineers for 1897, pages 1700-1702, and 1900, pages 2220-2221.

July 1, 1902 balance unexpended	\$3,000.00
July 30, 1903, amount expended during fiscal year	1,950.71
July 1, 1903, balance unexpended	1,049.29
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T 9.)

10. *Removing sunken vessels or craft obstructing or endangering navigation.*—An allotment of \$800 from the indefinite appropriation for removing sunken vessels or craft obstructing or endangering navigation was made on August 2, 1902, for the work of removing the wreck of the steamer *Baltimore* in the Warrior River, Alabama, about 5 miles above its mouth. No reasonable bid for this work could be obtained, and its performance by United States plant was therefore authorized. This work was completed in September, 1902, at a total cost of \$530.19, and the balance of the allotment, amounting to \$269.81, and the sum of \$133.50, the proceeds from the sale of the machinery and scrap iron recovered from the wreck were deposited in the Treasury October 28, 1902, to the credit of this appropriation.

On April 25, 1903, an allotment of \$118.25 from the indefinite appropriation for removal of wrecks was made in connection with the raising of several sunken pontoons in Mobile River, which an examination showed to be a menace to navigation. This allotment was used to reimburse the Mobile Harbor appropriation, from which the cost of removal was originally paid, and the owners of the pontoons, upon notification, reimbursed the United States to the extent of \$118.25—the entire cost of removal—which amount was covered into the United States Treasury to the credit of the indefinite wreck appropriation.

(See Appendix T 10.)

IMPROVEMENT OF THE PASSES OF THE MISSISSIPPI RIVER, OF BAYOU LAFOURCHE, BAYOU PLAQUEMINE, GRAND RIVER AND PIGEON BAYOUS, AND OF BAYOUS COURTABLEAU AND TECHE, LOUISIANA.

This district was in the charge of Lieut. Col. H. M. Adams, Corps of Engineers, with Lieut. Paul S. Bond, Corps of Engineers, under his immediate orders to November 13, 1902.

1. *Closing crevasse in Pass a Loutre, Mississippi River.*—Pass a Loutre is one of the three outlets of the Mississippi River. The crevasse forms an outlet from Pass a Loutre into an arm of the Gulf

known as Garden Island Bay, and was caused by the wearing away of the south bank of that pass at a locality $1\frac{1}{4}$ miles below Head of Passes.

The ditch where the crevasse first broke was 3 feet wide in 1872, and gradually increased from year to year. In January, 1891, the crevasse began to widen rapidly, but could not be checked on account of high water in the river. In July, 1891, it was 860 feet wide and 25 feet deep. Several attempts were made about this time by the estate of James B. Eads to close the crevasse, but it seemed a hopeless task, and was abandoned. On November 18, 1896, the crevasse was 2,230 feet wide, and on February 26, 1897, Congress appropriated \$250,000 for the closure.

The project approved July 10, 1897, provided for building a dam 6,650 feet long, in two sections, 1,900 and 4,750 feet long, respectively, forming an angle of 112° at a distance of 3,000 feet below the mouth of the crevasse, the dam to be constructed of Wakefield sheet piling backed with a double row of piles securely braced and bolted to stringers and the sheet piling, using a third row of brace piles where the depth of water exceeded 20 feet.

Under this project a contract for the work was approved December 10, 1897. Work was carried on from December 14, 1897, to January 27, 1898, and from August 5, 1898, to November 13, 1898. On the last-named date the work was considered completed and was accepted. At that time it seemed that the closure would prove a permanent success, notwithstanding the high stage of the river. A severe storm arose that night, and on November 14 the dam gave way in two localities and 170 feet of it washed out. Portions of the ends of the dam have washed away at intervals since then, and on June 30, 1903, the width of the break was 935.5 feet.

On February 17, 1898, Congress allotted \$10,000 from this appropriation for the expenses of a survey and report by a Board of Engineer officers upon the practicability of securing a channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in House Document No. 142, Fifty-fifth Congress, third session, and in the Annual Report of the Chief of Engineers for 1899 as Appendix U 19.

The amount expended from this appropriation up to June 30, 1903, was \$228,995.08, of which \$6,727.36 was for the survey of Southwest Pass, and \$1,000, reserved March 6, 1902, for expenses of the Office of the Chief of Engineers.

No work toward closing the crevasse was attempted during the past year, the amount available being insufficient for the purpose.

July 1, 1902, balance unexpended	\$21,004.92
July 1, 1903, balance unexpended	21,004.92

(See Appendix U 1.)

2. *Outlet of the Mississippi River.*—The river and harbor act of March 3, 1899, as amended by the act of June 6, 1900, appropriated \$200,000 for constructing a sill across Pass a Loutre and for constructing and operating one or more dredges for improving the outlet of the Mississippi River, and authorized continuing contracts to be made for

these purposes not exceeding \$300,000 additional. The sundry civil act of June 6, 1900, appropriated \$300,000 additional to cover the authorized continuing contracts.

On September 23, 1899, and July 2, 1900, the Secretary of War approved projects allotting, of the total of \$500,000 appropriated, aggregate amounts of \$175,000 for sill construction and \$325,000 for construction and operation of one dredge.

A contract for the construction of a mattress sill, weighted with stone, across the head of Pass a Loutre was entered into March 31, 1900. Work on the sill was commenced July 1, 1900, and completed December 31, 1900, at a total cost of \$174,914.06. This sill has prevented the enlargement of Pass a Loutre, and has increased the current across head of South Pass.

A contract for the construction of a dredge, to cost \$286,605, for work at this locality was entered into by Capt. J. C. Sanford, Corps of Engineers, the contract time for completion being February 28, 1903. The contract has been annulled and the dredge will be completed by the Navy Department. For details concerning its construction see Appendix I 6, herewith.

The sum of \$276,839.12 had been expended on this work up to June 30, 1903, of which \$174,914.06 was for the sill, \$100,758.74 for expenses connected with the construction of the dredge, and \$166.32 for payment of mileage and incidental expenses.

July 1, 1902, balance unexpended	\$320, 389. 59
June 30, 1903, amount expended during fiscal year	^a 97, 395. 03
July 1, 1903, balance unexpended	222, 994. 56
July 1, 1903, outstanding liabilities	^b 76. 52
July 1, 1903, balance available	222, 918. 04
(See Appendix U 2.)	

3. *Southwest Pass, Mississippi River.*—On February 17, 1898, Congress allotted \$10,000 from the appropriation for closing crevasse in Pass a Loutre, Mississippi River, for the purposes of a survey and report by a Board of Engineer officers upon the practicability of securing a channel of adequate width and 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass, Mississippi River. The survey was completed in 1898 and report submitted on January 7, 1899. This report is printed in House Document No. 142, Fifty-fifth Congress, third session, and in the Annual Report of the Chief of Engineers for 1899 as Appendix U 19. The Board presented a tentative project and stated that, in its opinion, the project presented would, if executed with vigor, secure a navigable channel of adequate width and of 35 feet depth at mean low water of the Gulf of Mexico throughout Southwest Pass at a cost which is not excessive, considering the vast commercial interests involved.

The item in the river and harbor act approved March 3, 1899, making appropriation for improving outlet of the Mississippi River, provided for the appointment of a Board of Engineers to prepare a project for a channel 35 feet in depth throughout Southwest Pass, and

^a Includes \$97,228.71, expended by Capt. J. C. Sanford, Corps of Engineers, on account of construction of dredge.

^b On account of construction of dredge.

appropriated \$20,000 for expenses of the Board. The Board of Engineers appointed under provisions of this act submitted a report and project on January 11, 1900. The report was transmitted to Congress and is printed in House Document No. 329, Fifty-sixth Congress, first session, and also on pages 2287-2302, Annual Report for 1900.

The project of the Board contemplated securing a channel 1,000 feet wide and 35 feet deep at mean low water throughout the Southwest Pass, by dredging; the construction of two jetties to maintain the channel; the construction of sills across Cubits Gap, The Jump, and Baptiste Collets Canal; the closing of all minor outlets below the forts; the construction of a dredge in addition to the one provided for by the river and harbor act of March 3, 1899, and the sundry civil act of June 6, 1900, under appropriation for improving outlet of the Mississippi River; other necessary plant, such as tugboats, barges, tracks, buildings, etc., and the purchase of land at the shore ends of the jetties; the whole estimated to cost \$6,000,000, and \$150,000 additional per annum for maintenance.

In accordance with the report of this Board the river and harbor act of June 13, 1902, appropriated \$750,000, and authorized continuing contracts to be made to the amount of \$2,750,000 additional toward the prosecution of the project, at the same time authorizing the Secretary of War, in his discretion, to modify the plans described in the report of the Board. The sundry civil act of March 3, 1903, appropriated \$1,000,000 additional to be applied to this work.

A project for the expenditure of the amounts appropriated and for which contracts were authorized by the act of June 13, 1902, containing proposed modifications of the project contained in House Document No. 329, Fifty-sixth Congress, first session, was approved by the Secretary of War April 6, 1903. This project contemplates the construction of a dredge, dredging, purchase of land, and construction of two jetties to be built of mattresses, stone, and concrete.

An additional dredge was provided for by the river and harbor act of June 13, 1902, and a contract has been entered into for its construction at a cost of \$240,000, exclusive of the auxiliary pipe line and pontoons, which will be contracted for during the ensuing year. For details see Appendix I 6, herewith.

During the past fiscal year steps were taken for the acquisition of the land required in connection with this improvement, and bids for the construction of two jetties were opened on June 30, 1903.

July 1, 1902, balance unexpended	\$750,000. 00
Amount appropriated by sundry civil act approved March 3, 1903	1,000,000. 00
	1,750,000. 00
June 30, 1903, amount expended during fiscal year	208. 88
July 1, 1903, balance unexpended	1,749,791. 12
July 1, 1903, outstanding liabilities	14. 40
July 1, 1903, balance available	1,749,776. 72
{ Amount (estimated) required for completion of existing project	4,250,000. 00
{ Amount that can be profitably expended in fiscal year ending June	
30, 1905, in addition to the balance available July 1, 1903	1,250,000. 00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

(See Appendix U 3.)

4. *Examinations and surveys at South Pass, Mississippi River.*—The act of Congress approved March 3, 1875, required examinations and surveys to be made at South Pass, Mississippi River, and reports upon the depth of water and width of channel secured and maintained from time to time in said channel, together with such other information as the Secretary of War may direct. The act of August 11, 1888, made an annual appropriation of \$10,000 for this work. The river and harbor act approved June 13, 1902, contained the following:

The provisions of the act of March third, eighteen hundred and seventy-five, and of the act of August eleventh, eighteen hundred and eighty-eight, with regard to examinations and surveys at South Pass, mouth of the Mississippi River, shall remain in force as fully as though they were herein reenacted in express terms, notwithstanding the termination of the contract with the late James B. Eads and associates.

Up to January 29, 1901, the work of making examinations and surveys at South Pass was carried on under the provisions of the acts of March 3, 1875, and August 11, 1888. From January 29, 1901, to June 30, 1902, examinations and surveys were made with funds appropriated by the act of June 6, 1900, for maintenance of South Pass channel.

Since June 30, 1902, under the act of June 13, 1902, repeated surveys have been made of the shoaler localities in South Pass. Complete surveys of the jetty channel and of the channel beyond the ends of the jetties to deeper water in the Gulf were made each month during the fiscal year. A detailed annual survey was made of the 14 miles of channel from the main river to deep water in the Gulf.

On January 1, 1903, the plane of reference used in reducing soundings in South Pass was changed from average flood tide to mean low tide.

The amount expended upon this work during the past fiscal year was \$9,115.80, exclusive of outstanding liabilities amounting to \$884.20.

(See Appendix U 4.)

5. *Maintenance of South Pass channel, Mississippi River.*—The act of Congress of March 3, 1875, amended by acts of June 19, 1878, and March 3, 1879, made provision for the construction by James B. Eads, or his representatives, of jetties and other works in South Pass, to secure and maintain a channel 26 feet in depth through the pass, and through the jetties at the mouth of the pass a channel "26 feet in depth, not less than 200 feet in width at the bottom, and having through it a central depth of 30 feet without regard to width." A contract was made for the maintenance of such a channel for a period of twenty years.

On January 28, 1901, this contract expired and the work of maintenance is being continued under the provisions of the emergency river and harbor act of June 6, 1900, which provides that at the termination of the contract with the representatives of the estate of James B. Eads, deceased, the Secretary of War shall take charge of and maintain the channel, jetties, and auxiliary works at South Pass, for which a sum not to exceed \$100,000 per year is appropriated until otherwise provided for by law.

The sum of \$25,000 was also appropriated by the sundry civil act of June 6, 1900, for the purpose of altering a dredge or dredges of the Mississippi River Commission so as to make the same available for use in South Pass in case any unusual obstruction to navigation occurred. Of this appropriation \$17,139.72 was expended by the secretary of the

Mississippi River Commission and \$1,957.66 by the officer in local charge of the improvement of the pass, the balance, \$5,902.62, reverting to the Treasury.

The river and harbor act approved June 13, 1902, contained the following provisions for this work, viz:

The Secretary of War is hereby directed to maintain the channel in the South Pass of the Mississippi River with the utmost efficiency, and for that purpose the dredge boat *Beta*, or any other available Government dredge, may be used, and the lands and buildings on either side of the South Pass, or such part thereof as in his discretion may be necessary, may be purchased for the United States from the heirs or legal representatives of James B. Eads, deceased, and for the purposes named herein seventy-five thousand dollars is hereby appropriated in addition to the one hundred thousand dollars annually allowed for maintenance in the act of Congress approved June sixth, nineteen hundred.

From February 4 to June 27, 1901, and from May 26 to October 4, 1902, the channel was maintained by dredging with the *Beta*. From July 2 to 25 and from October 5 to 26, 1901, dredging was done by the U. S. dredge *Sabine*.

From September 18 to October 17, 1902, the dredge *Sabine* was employed in removing a shoal that had formed in the channel beyond the ends of the jetties. The available channel depth was increased from 25.6 to 30 feet, with a width of 100 feet. When the river began rising in January, 1903, the channel beyond the ends of the jetties began to shoal and the *Sabine* was again transferred to South Pass. The dredge arrived on April 5, and at the end of the fiscal year was still engaged in dredging in the channel beyond the ends of the jetties.

The dredge *Beta* was retransferred for work at South Pass in February, 1903, arriving at Port Eads February 15, 1903. On account of the stage of the river and the condition of the channel but little dredging has been necessary, but the dredge has been held in readiness to remove any shoal that should appear in the channel. From April 3 to 27 the dredge was engaged on the work of filling in the low ground of the reservation at Fort St. Philip, La., under authority of the Secretary of War, the funds for the work being supplied by the Quartermaster's Department.

Repair work on jetties and auxiliary works was commenced August 5, 1901. These works have been maintained in good condition since that time by the addition, from time to time, as required, of willows, stone, piles, and waling timber.

The following amounts were collected and deposited by the United States district attorney, in accordance with provisions of the river and harbor act of March 3, 1899, on account of damages to the works at South Pass: \$774.89 on March 12, 1903, on account of damages by the steamer *Lake Michigan*; \$175 on March 21, 1903, on account of damages by the steamer *Soperga*; and \$190 on March 25, 1903, for damages done by the steamer *Venus*.

Portions of the plant and materials of the Eads estate have been purchased at various times since the termination of their contract with the United States, at a total cost of \$27,636.94, for use in maintaining the jetties and auxiliary works. Of this amount \$21,263.32 was expended for the purchase of plant and \$6,373.62 for materials.

On December 6, 1902, the legal representatives of James B. Eads, deceased, accepted the offer of \$35,000 made by the Department November 11, 1902, for the lands and buildings owned by the estate on both sides of South Pass. The purchase price was approved by the

Secretary of War December 11, 1902, and was paid into court and title secured for the United States on July 8, 1903.

The sum of \$277,582.24 was expended on this work from January 29, 1901, to June 30, 1903.

Comparative statement of receipts and shipments for four years for the port of New Orleans, La.

Year ending December 31—	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899.....	3, 176, 740		
1900.....	2, 773, 645		403, 095
1901.....	4, 213, 869	1, 440, 224	
1902.....	3, 312, 058		

^a Incomplete returns.

PERMANENT APPROPRIATION.

July 1, 1902, amount appropriated by emergency river and harbor act approved June 6, 1900, for fiscal year 1903.....	\$100, 000. 00
Amounts collected and deposited by United States district attorney for damages to works	1, 139. 89
	101, 139. 89
June 30, 1903, amount expended during fiscal year	\$101, 039. 89
June 30, 1903, outstanding liabilities.....	100. 00
	101, 139. 89

APPROPRIATION MADE BY RIVER AND HARBOR ACT OF JUNE 13, 1902.

July 1, 1902, balance unexpended	\$75, 000. 00
June 30, 1903, amount expended during fiscal year.....	\$24, 918. 57
June 30, 1903, outstanding liabilities.....	43, 261. 13
	68, 179. 70
July 1, 1903, balance available	6, 820. 30

(See Appendix U 5.)

6. *Bayou Lafourche, Louisiana.*—Bayou Lafourche is an outlet of the Mississippi River, forming a junction 70 miles above New Orleans. It is about 105 miles long and flows into the Gulf of Mexico. In its original condition it was obstructed by logs, snags, and overhanging trees. The project of 1879 provided for the removal of such obstructions to improve low-water navigation. Work under this project was carried on until 1885, with appropriations aggregating \$30,000.

The project of June 11, 1886, provided for the construction of a lock to connect the bayou with the Mississippi River and for dredging a channel 75 feet wide and 5 feet deep at mean low water of the Gulf, at an estimated cost of \$450,000 and \$8,000 annually thereafter for maintenance. Work under this project was confined to dredging to maintain low-water navigation, the appropriations at any one time being insufficient to warrant the commencement of the lock, and the exigencies of commerce not permitting a suspension of the dredging.

The project of 1886 was modified on September 23, 1896, and held in abeyance the construction of the lock, restricting operations to dredging to maintain low-water navigation, at an estimated cost of \$25,000 per annum.

The project of July 11, 1895, for the expenditure of \$40,000, appropriated August 18, 1894, recommended that \$30,000 be reserved for the purchase of a dredge whenever it should become advisable to make such purchase.

Dredging operations under the modified project of 1896 were carried on in 1897 and 1898 from the head of the bayou to about 3 miles below Thibodeaux, improving about 38 miles of channel. This improvement is not permanent, as sand bars form each year after the subsidence of floods in the Mississippi River.

The project of July 11, 1895, so far as the reservation of \$30,000 for purchase of a dredge is concerned, was modified on December 7, 1899, to allow the expenditure of \$9,000 of this amount in dredging to maintain flatboat navigation during low water. With these funds and the \$7,500 appropriated March 3, 1899, dredging was carried on from August 9, 1899, to January 22, 1900, and a depth of 3 feet during low water was secured from the head of the bayou at Donaldsonville to a point 8 miles below.

The project of July 11, 1895, was further modified on May 11, 1900, to allow the expenditure of funds remaining to the credit of this appropriation in dredging during the low-water season. Dredging was carried on from July 25, 1900, to December 8, 1900, and from June 25 to December 30, 1901, to maintain channel during low-water seasons of 1900 and 1901, respectively.

The amount expended on this work up to June 30, 1903, was \$257,877.85.

To maintain channel during low-water season of 1902 dredging was done from September 5 to December 13, 1902. The work extended over a stretch of $4\frac{1}{2}$ miles, the actual dredging having a length of $2\frac{1}{2}$ miles.

The conditions existing in the bayou at this time are the same that prevailed on June 30, 1902. Steamboats ply the stream for about eight months of each year, but during the remaining months the commerce is carried by flatboats from the Mississippi River. The width of the bayou at low water is about 60 feet; the navigable depth is 18 inches.

No estimate for additional funds for this work is asked, as Congress has authorized the construction of a lock and dam at the head of the bayou by a State levee board.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	273,686		
1895.....	263,607		10,079
1896.....	229,891		33,716
1897.....	217,292		12,599
1898.....	269,398	52,106	
1899.....	206,516		62,882
Calendar year—			
1899.....	157,258		49,258
1900.....	210,315	53,057	
1901.....	137,357		72,958
1902.....	182,745		4,612

July 1, 1902, balance unexpended	\$8,473.43
June 30, 1903, amount expended during fiscal year	6,351.28
July 1, 1903, balance unexpended	2,122.15
(See Appendix U 6.)	

7. *Bayou Plaquemine, Grand River, and Pigeon Bayous, Louisiana.*—Prior to 1867 the largest steamboats could pass through Bayou Plaquemine into Grand Lake and other connecting water routes, but at that time the police jury of Iberville Parish closed the bayou by means of a dam, shutting out the waters of the Mississippi. Grand River and Pigeon Bayous were obstructed by snags, logs, overhanging trees, and sand bars.

The present project is based upon legislation by Congress, according to project and estimate submitted February 11, 1887, and provides for dredging a channel in Bayou Plaquemine 60 feet wide and 6 feet deep from deep water up to the Plaquemine dike, constructing a lock to connect the bayou with the Mississippi River, securing the mouth of the bayou from further caving, and removing obstructions from Grand River and Pigeon Bayous; total estimated cost, \$1,708,250.

The project of 1887 was modified on April 10, 1899, to allow for dredging Bayou Plaquemine to a depth of 10 feet and a width of 125 feet.

The protection of the bank of the Mississippi River at the mouth of the bayou was added to the improvement in 1888, and in act of July 13, 1892, the improvement of Grand River and Pigeon Bayous was also incorporated.

The act of June 3, 1896, authorized continuing contracts to be entered into to complete the project of improvement, not to exceed \$1,173,250, exclusive of the amounts therein and previously appropriated.

Dredging was carried on in Bayou Plaquemine in 1890, 1891, 1892, and 1894, resulting in securing a channel 6 feet deep and 60 feet wide from the mouth to the railroad bridge.

Work was carried on under the modified project from October 29, 1899, to June 5, 1902, under contract dated July 15, 1899, for the rectification of Bayou Plaquemine. About four-tenths of the work provided for under the contract has been completed to the required depth of 10 feet and width of 125 feet. The time limit on this contract has been waived for a reasonable period.

An allotment of \$75,000 was made from the appropriation of 1888 for securing the bank of the Mississippi River at the head of the bayou. Five submerged spur dikes, placed at intervals of about 900 feet, with intervals protected by revetment, were completed in 1894. These dikes and revetments form a continuous protection 1,400 feet long below the site of the lock and 1,200 feet above, with an interval of 500 feet opposite the lock site left for excavating the necessary channel to the lock. On November 30, 1901, and January 29, 1902, two mattresses, 400 by 600 feet and 400 by 450 feet, respectively, were sunk in the river and heavily loaded with stone for protection of the banks near the proposed approach to the lock.

In 1893, 1894, and 1897 obstructions were removed from the mouth of Bayou Sorrel and down Grand River through Pigeon Bayou to Grand Lake, a distance of 30 miles. Flat Lake, at the mouth of Grand River, was dredged in 1893 and 1897.

Work of dredging and removing obstructions from Grand River was carried on under contract of November 25, 1889, until April 20, 1901. Obstructions were removed from the mouth of Bayou Plaquemine to 2 miles below Bayou Pigeon, and at Bay Natchez, a distance of 30 miles. A survey of Flat Lake and Bay Natchez was made in 1901, and a project for dredging a 50-foot channel, 10 feet deep, through them was approved April 20, 1901, and modified March 21, 1902. A contract for the work was approved May 1, 1902. The work was commenced in Flat Lake July 5 and in Bay Natchez August 7, 1902. The channel through Flat Lake was completed on January 30, 1903. At the end of the fiscal year there remains to be excavated about 86,500 cubic yards of material to complete the channel through Bay Natchez.

With funds appropriated in 1894 the work of constructing a cofferdam, excavating, and driving piles for foundation for the lock was carried on from 1895 to 1898 and completed.

In 1891 a project for the construction of a lock was submitted, but the funds available were insufficient to warrant its commencement at that time. The Board of Engineer officers appointed to prepare plans and specifications estimated the cost of the lock at \$700,000. Revised plans and specifications for the construction of the lock and approaches were approved October 27, 1897, and December 2, 1897, respectively, and a continuing contract for the work was entered into May 28, 1898, and approved June 17, 1898. The work was commenced in August, 1898. On June 30, 1902, the floor and walls of the lock had been completed; miter sills, inlet pipes, and snubbing hooks had been placed; the excavation for the approaches, the fill behind walls, construction of connection levees, and erection of gates remained to complete the contract. No work under this contract was accomplished during the past fiscal year. By direction of the Chief of Engineers, supplemental contract was entered into with the contractors on June 18, and approved by the Secretary of War June 24, 1903, annulling their contract for construction of lock and approaches. Revised plans for construction of lock gates and of the approaches to the lock, including excavation and fill, were approved on June 11, 1903.

A contract for the construction of power house and operating machinery for the lock for \$114,000 was entered into November 18, 1899. This work will be commenced when the lock is nearer completion.

For the approach to the lock 1.25 acres of land on the north side and 0.31 acre on the south side were purchased August 24, 1900, for \$7,500.

A contract was approved May 5, 1902, for the construction of a protection levee from the northeast corner of the lock to connect with the main levee system in front of the lock. The work was completed in July, 1902.

The sum of \$1,013,015.45 was expended on these improvements up to June 30, 1903, including \$1,000 withdrawn by Office of the Chief of Engineers June 20, 1901, for office expenses.

During high water there is a depth of from 10 to 12 feet in these streams, but during low water there is a depth of only 4 feet in Bay Natchez and 4½ feet in Flat Lake except in the dredged channel.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	133,752	54,993	.....
1895.....	120,542		13,210
1896.....	92,379		28,163
1897.....	57,055		35,324
1898.....	76,626	19,571	.....
1899.....	89,301	12,675	.....
Calendar year—			
1899.....	111,750	22,449	.....
1900.....	88,543		23,207
1901.....	283,000	194,457	.....
1902.....	292,000	9,000	.....

July 1, 1902, balance unexpended.....	\$695,007.97
June 30, 1903, amount expended during fiscal year.....	68,023.42
July 1, 1903, balance unexpended.....	626,984.55
July 1, 1903, outstanding liabilities.....	11,948.20
July 1, 1903, balance available.....	615,036.35
July 1, 1903, amount covered by uncompleted contracts.....	245,316.06
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	35,000.00

(See Appendix U 7.)

8. *Bayou Courtableau, Louisiana.*—A description of the conditions, project, etc., is contained in the Annual Report of the Chief of Engineers for 1902, page 322.

The sum of \$58,567.46 was expended on this improvement up to January 17, 1903.

No work was done during the past fiscal year. The balance of \$132.54 remaining in the Treasury to the credit of the appropriation not being sufficient for any useful work of improvement, the work was dropped from the list of duties January 17, 1903.

July 1, 1902, balance unexpended.....	\$132.54
July 1, 1903, balance unexpended (in Treasury).....	132.54

(See Appendix U 8.)

9. *Bayou Teche, Louisiana.*—Bayou Teche is an important commercial stream of southern Louisiana, and finds its outlet into the Gulf of Mexico through Atchafalaya River. Prior to improvement it had a depth of 8 feet to St. Martinville, La., but navigation was rendered dangerous by numerous obstructions. Above St. Martinville the bayou was navigable by steamboats during high water. The project of 1870 provided for removal of obstructions from the head to the mouth of the bayou. Work under this project was carried on from 1870 to 1886, the stream being cleared of logs, snags, wrecks, overhanging trees, and a number of sand bars. The improvement was not permanent and other obstructions formed.

The project of 1891 provided for the removal of obstructions between St. Martinville, La., and the mouth of the bayou, a distance of about

80 miles. Work under this project has been carried on since 1891, obstructions being removed as appropriations were made. To June 30, 1903, \$88,473.82 had been spent upon this improvement.

With funds appropriated by the river and harbor act approved June 13, 1902, dredging and the removal of obstructions were carried on from November 13, 1902, to March 13, 1903. The work of improvement extended from Vida Ponton Bridge to St. Martinville, a distance of 15 miles, the actual dredging and snagging covering an aggregate length of 7.61 miles.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	383, 154	268, 074	.....
1895.....	279, 928		103, 226
1896.....	293, 685	13, 757	.....
1897.....	303, 029	9, 344	.....
1898.....	238, 783		64, 246
1899.....	296, 091	47, 308	.....
Calendar year—			
1899.....	272, 975		13, 116
1900.....	212, 109		60, 866
1901.....	335, 583	123, 474	.....
1902.....	408, 454	72, 871	.....

July 1, 1902, balance unexpended	\$7, 641. 72
June 30, 1903, amount expended during fiscal year	7, 615. 54

July 1, 1903, balance unexpended	26. 18
July 1, 1903, outstanding liabilities	1. 08

July 1, 1903, balance available	25. 10
---------------------------------------	--------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	7, 500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix U 9.)

IMPROVEMENT OF HOMOCHITTO RIVER, MISSISSIPPI, AND OF CERTAIN RIVERS AND HARBORS IN SOUTHERN LOUISIANA AND EASTERN TEXAS.

The works in this district were in the charge of Lieut. Col. H. M. Adams, Corps of Engineers, to December 1, 1902, and of Capt. C. S. Bromwell, Corps of Engineers, since that date. Division Engineer, Lieut. Col. H. M. Adams, Corps of Engineers, since December 1, 1902.

1. *Homochitto River, Mississippi.*—About 8 miles above Fort Adams, Miss., the Homochitto enters the Mississippi River. For the first 3 miles from that point it is designated as the "Narrows," and for a distance of 12 miles farther as "Old River." A preliminary examination made in 1896 showed that the Narrows had a depth of 5 feet at low water and a width of 150 feet, except for a distance of about 1 mile, where the stream is very narrow and shoal. This narrow and shoal portion was obstructed by snags and logs. Old River was about 1,000 feet wide and about 2 feet in depth over the shoalest places at low water. It was clear of obstructions. Above Old River the Homo-

chitto River had a navigable depth of about 8 feet and a width of about 150 feet for a distance of about 45 miles, but it was thickly obstructed by snags, logs, and overhanging trees.

The act of March 3, 1899, appropriated \$16,000 for the removal of obstructions between the mouth of the river and the Yazoo and Mississippi Valley Railway bridge, a distance of about 60 miles, and a project for the work was approved April 18, 1899.

Work under this project was commenced November 27, 1899, and continued until August 13, 1900, resulting in the improvement of the channel for a distance of about 18 miles and a width varying from 60 to 200 feet.

Under act of June 13, 1902, \$2,000 was appropriated for the maintenance of this improvement, which sum, together with the unexpended balance from former appropriations, made \$2,521 available for expenditure under a project approved July 17, 1902, providing for the maintenance of the improved channel for a distance of 14 miles, or as far as available funds would permit. Work was begun under this project September 4, 1902, and continued until January 12, 1903, when operations were suspended on account of the high stage of the river. The improved channel was cleared of obstructions from the mouth of the Old River to its north fork, a distance of about 5 miles.

The amount expended to July 1, 1903, is \$17,569.90.

The improvement is not permanent, as snags and logs continue to accumulate in the improved portion of the stream. There still remains about 36 miles of the channel to improve to complete the project of 1899.

Detailed commercial statistics were not available; it has been ascertained, however, that during the past year about 500,000 feet of lumber and 1,600 tons of miscellaneous merchandise have been transported over this river, the value of which is estimated to be about \$35,000.

July 1, 1902, balance unexpended	\$2, 521. 60
June 30, 1903, amount expended during fiscal year.....	2, 091. 50
July 1, 1903, balance unexpended	430. 10

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	1, 500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix V 1.)

2. *Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana.*—(a) *Bogue Chitto.*—Originally navigation on this stream was impeded by snags, logs, and overhanging trees throughout its entire length, except during very high stages of water. The minimum width of channel was 80 feet and the least depth of water 3 feet.

The present project, adopted in 1890, provided for securing and maintaining a channel 3 feet deep from the mouth of the river to Alford's bridge, near Summit, Miss., a distance of about 190 miles, by closing the west mouth and several small run-out bayous, and by the removal of obstructions and overhanging trees, at an estimated cost of \$55,000.

Owing to the inadequacy of appropriations it has been possible to carry out the above project only as far as Cross River, about 80 miles.

which distance had to be cleared periodically to maintain the improvement. On June 30, 1900, the condition of the river permitted of navigation being had by light-draft boats from the mouth of the river to Cross River.

Under the project approved by the Chief of Engineers, United States Army, July 31, 1902, \$3,000, allotted from the \$9,500 appropriated by act of June 13, 1902, for "Improving Bogue Chitto, Chefuncte River, Bogue Falia, Tickfaw River and tributaries, Amite River, and Bayou Manchac, Louisiana," was applied to the maintenance of the improved channel by the removal of such snags, logs, and overhanging trees as had accumulated.

On June 30, 1903, there had been expended \$27,676.66, of which amount it is estimated \$12,764.06 has been applied to maintenance.

The report of the survey upon which the project of 1890 is based will be found in the Annual Report of the Chief of Engineers for 1889, page 1465, and an account of the improvement in the same reports for the years 1897 and 1900, pages 1703 and 2222, respectively.

Commercial statistics covering the calendar year 1902-3 have not been obtainable, but it has been ascertained that the commerce over this stream consists mainly of the rafting of timber for the surrounding sawmills.

(b) *Chefuncte River and Bogue Falia.*—Prior to improvement of Chefuncte River a bar with a depth of only $4\frac{1}{2}$ feet of water obstructed the entrance to the mouth of the river; from this point to its junction with the Bogue Falia, a distance of 10 miles, the river was from 300 to 800 feet in width, with a channel 15 feet in depth, navigable for steamers and sailing vessels, but obstructed by snags and overhanging trees. Above this point the stream is not navigable.

Bogue Falia was navigable for small steamers from point of junction with the Chefuncte to Grants Landing, 4 miles above; for sailing vessels drawing 5 feet or less to Covington, 2 miles farther; obstructed by snags and overhanging trees. Not navigable beyond Covington.

The original project of 1880 provided for dredging through the bar at the mouth of the Chefuncte River and for the removal of all obstructions between its mouth and Covington on the Bogue Falia, at an estimated cost of \$5,460. It was modified in 1884 to permit of the construction of a breakwater to protect the channel dredged across the bar at mouth of the Chefuncte River; estimated cost, \$1,500.

For an account of the improvements under original project and modification, see Annual Report of the Chief of Engineers for 1896, page 1485.

The work of maintenance was commenced under the project approved August 10, 1892. No work was done during the fiscal year ending June 30, 1902, none being considered necessary. During the past year a number of obstructions to navigation have been removed, and the channel across the bar, which had refilled, was dredged for a length of 1,239 feet and an average width of 150 feet. Depth of water in channel, 6.8 feet.

Amount expended to June 30, 1903, is \$12,305.99, of which \$5,805.99 has been applied toward maintenance.

In February, 1903, \$1,194.01 remaining to the credit of this allotment was transferred to that for "Improving Amite River and Bayou Manchac, Louisiana."

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893.....	30, 284		19, 770
1894.....	242, 464	212, 180	
1895.....	49, 778		192, 646
1896.....	67, 680	17, 902	
1897.....	110, 034	42, 354	
1898.....	99, 506		10, 529
1899.....	97, 789		1, 716
Calendar year—			
1899.....	156, 500	58, 711	
1900.....	86, 856		69, 644
1901.....	92, 874	6, 018	
1902.....	247, 890	155, 016	

(c) *Tickfaw River and tributaries.*—These streams, the Tickfaw, Blood, Natalbany, and Ponchatoula rivers, had a 9-foot channel navigable for steamers and schooners for an aggregate distance of 38 miles, but obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1881, provided for the removal of obstructions as far as appropriations would permit; estimated cost, \$10,230. The project for maintenance of the improvement was approved August 10, 1892, and under these two projects the work has been carried on since 1881.

During 1896 the water hyacinths at the mouth of the Tickfaw River were removed, and in 1889 a bar, which had formed at the same locality, was cut away. About 30 miles of the river and its tributaries was improved.

Under the project approved July 31, 1902, the work of maintenance was continued until November 22, 1902, at which time these streams had ample depth for the commerce to be benefited and were practically free from obstructions, except as regards the water hyacinths.

Amount expended to June 30, 1903, is \$12,920.56, of which it is estimated that \$4,920.56 was applied for maintenance.

Comparative statement of receipts and shipments for past ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	40, 003	26, 009	
1895.....	23, 384		16, 619
1896.....	72, 851	49, 467	
1897.....	58, 115		14, 736
1898.....	75, 579	17, 764	
1899.....	52, 961		22, 618
Calendar year—			
1899.....	79, 300	26, 339	
1900.....	55, 540		23, 700
1901.....	56, 464	924	
1902.....	152, 342	95, 878	

(d) *Amite River and Bayou Manchac, Louisiana.*—Prior to improvement the Amite River was navigable for small steamers for a distance of 45 miles from its mouth, and Bayou Manchac for a distance of 10 miles, but both streams were obstructed by snags, logs, and overhanging trees.

The original project, as adopted in 1880 and modified in 1883 and 1888, provided for the removal of obstructions in Bayou Manchac from Hope Villa to the Amite River, and in the latter stream to Lake Maurepas (its mouth), at an estimated cost of \$31,760.

The work of maintenance has been carried out under the project of 1892 and subsequent projects up to February 4, 1903, when funds were exhausted.

Amite River was improved for a distance of 42 miles from its mouth, and Bayou Manchac for a distance of 10 miles from its junction with the former stream. A turning basin was made at the upper limit of improvement in Bayou Manchac. During the past year a channel 3,400 feet long, 100 feet wide, and 8 feet in depth was cut through the bar at the mouth of the Amite River.

The improvement is not considered permanent, as snags and logs will continue to accumulate and obstruct navigation in these streams.

Amount expended to June 30, 1903, is \$37,360.35, of which it is estimated \$12,457.67 has been expended for maintenance.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1893.....	22,099	3,569	.....
1894.....	157,902	135,803	.....
1895.....	42,983		114,919
1896.....	55,103	12,120	.....
1897.....	49,509		5,594
1898.....	54,749	5,240	.....
1899.....	60,305	5,556	.....
Calendar year—			
1899.....	59,850		455
1900.....	25,400		34,450
1901.....	69,918	44,418	.....
1902.....	291,787	221,969	.....

July 1, 1902, balance unexpended	\$9,653.29
June 30, 1903, amount expended during fiscal year	9,116.85

July 1, 1903, balance unexpended	536.44
--	--------

(Amount (estimated) required for completion of existing project	30,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	12,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix V 2.)

3. *Channel, bay, and passes of Bayou Vermilion, and Mermentau River and tributaries, Louisiana.*—(a) *Channel, bay, and passes of Bayou Vermilion.*—Prior to improvement the upper 12 miles of Bayou Vermilion was only 2 feet deep and its lower portion, through the bay and passes, not less than 5½ feet deep. It had a width varying from 100 to 400 feet. The channel, however, was obstructed by snags, logs, and overhanging trees.

The original project, adopted in 1882, provided for the removal of these obstructions, the erection of guide piling to indicate the limits of the channel over the bars in Vermilion Bay, and for securing a navigable depth of 5½ feet up to the railroad bridge near Lafayette, La.

Operations were carried on with the appropriations made in 1892, 1893, 1896, and 1899, and the stream cleared of obstructions from Abbeville, La., to the railroad bridge near Lafayette, La., a distance of about 36 miles. No work was done from February, 1900, to September, 1902.

An examination in 1901 showed that obstructions had again formed, and the project approved July 12, 1902, provided for their removal from the mouth of the bayou to the railroad bridge near Lafayette, La., or as far as funds available would permit. About 20 miles of the bayou was cleared of obstructions under this project to June 30, 1902, leaving about 18 miles still to be cleared, which work is now under contract and in process of execution. At date of this report there is an available channel from the mouth of the bayou to the railroad bridge near Lafayette, La., for vessels drawing 5½ feet of water or less.

The amount expended to June 30, 1903, is \$20,725.97.

The improvement is not considered permanent, as obstructions will continue to form and must periodically be removed.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	43,882	8,151	.....
1895.....	12,933	.....	30,889
1896.....	13,022	29	.....
1897.....	6,126	.....	6,896
1898.....	8,862	2,736	.....
1899.....	14,969	6,107	.....
Calendar year—			
1899.....	7,650	.....	7,319
1900.....	21,150	13,500	.....
1901.....	31,385	10,235	.....
1902.....	37,000	5,615	.....

(b) *Mermentau River and tributaries.*—Prior to improvement these streams had depths varying from 7 to 30 feet. The channel through Grand Lake was 6 feet deep, and the depth at the mouth of the river was about 13 feet. The width varies from 70 feet near Viterboville, to 350 feet at Lake Arthur. The channel was crooked and obstructed with snags and logs.

The original project of 1892 provided for the removal of obstructions in the upper river and the construction of brush dams in the lower river to remove existing mud flats. The estimated cost was \$23,615.25.

With the appropriations of 1892, 1894, and 1896, operations were carried on from December, 1892, to December, 1899, and 38 miles of the channel, from the lower end of Lake Arthur downstream, was cleared of obstructions; two brush dams, 2,500 and 3,000 feet in length, respectively, were built in Mud Lake, and a channel 8 feet in depth and 50 feet in width was cut across the flats in Mud Lake and maintained as the exigencies of navigation required.

The project, approved July, 1902, provided for the expenditure of the allotment from the appropriation of June 13, 1902, together with the unexpended balance from former appropriations, for the restoration of the brush dams in Mud Lake to their original condition, and for the removal of such obstructions as might be found to be necessary to facilitate navigation.

Under this project the necessary repairs to the upper brush dam in Mud Lake were completed under contract on June 2, 1903.

The amount expended to June 30, 1903, is \$25,066.34, of which it is estimated that \$8,349.86 has been applied toward maintenance of the improvement.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	5,437		10,813
1895.....	15,965	10,518	
1896.....	16,459	504	
1897.....	12,210		4,249
1898.....	18,650	6,400	
1899.....	22,236	3,586	
Calendar year—			
1899.....	2,866		19,370
1900.....	27,034	24,168	
1901.....	29,291	2,257	
1902.....	50,326	21,035	

July 1, 1902, balance unexpended.....	\$13,043.22
June 30, 1903, amount expended during fiscal year.....	7,720.28

July 1, 1903, balance unexpended.....	5,322.94
---------------------------------------	----------

July 1, 1903, amount covered by uncompleted contracts.....	3,500.00
--	----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended, July 1, 1903.....	3,000.00

(See Appendix V 3.)

4. *Mouth and passes of Calcasieu River, Louisiana.*—Prior to improvement there existed a depth of 6½ feet over the outer bar at the entrance to Calcasieu Lake. The lake was 15 miles in length, with a depth of 6 feet. The depth of water over the inner bars was 3½ feet, and from the upper bar to Lake Charles, Louisiana, the river was not less than 8 feet deep.

Under the original project of 1872, with the modification of 1881, a channel 8 feet in depth, 70 feet wide, and 7,500 feet in length was cut through the inner bars during 1874, 1882, and 1883, but this channel having shoaled to 3½ feet it was redredged in 1886 under the project of that year and a plank revetment, to provide against refilling, was commenced. The noncompletion of this revetment caused the refilling of this channel.

Appropriations made in 1888, aggregating \$85,000, for the construction of a revetment and parallel jetties, in accordance with the project of 1886, not being sufficient, this sum was increased by \$100,000 in 1892.

The project of 1892, under which the present work is being carried on, provides for the dredging of a channel 8 feet in depth through the inner bars and revetting this channel; to construct parallel jetties of brush and stone at the entrance to the outer pass, and to dredge a channel between these jetties to a depth of 12 feet if necessary. The total estimated cost of these improvements is \$600,000.

Under this project the revetment was completed in August, 1893. A channel 8 feet deep and 50 feet wide, connecting deep water in Calcasieu Pass and Lake, was dredged in 1894, 1895, and 1898. Construction of the east jetty was carried on in 1894, 1895, and 1896, and on the west jetty in 1897. In 1900, with an appropriation of \$35,000, the foundation of the west jetty was extended 1,000 feet, making its total length 3,200 feet.

The amount expended to June 30, 1903, is \$451,213.78, of which \$251,834.64 has been expended under the present project. On that date the channel had been redredged for a distance of 3,770 feet, with a width of 60 feet and a mean low-water depth of 8 feet. Under authority of the Chief of Engineers, and with the consent of the contractor for that work, \$5,000 was transferred from the allotment for repairs to and extension of the east jetty, with which amount the length of channel was increased to 5,770 feet on January 24, 1903.

A contract for the necessary repairs to and extension of the east jetty was approved November 15, 1902, but at date of this report no work had yet been commenced.

An examination and survey of the channel was made in April, 1903, and it was found that an extension of about 4,600 feet of the redredged channel would completely remove all existing obstructions, which consist principally of materials used in the construction of the old revetment, and provide a navigable channel 11,000 feet in length, 60 feet in width, and 8 feet in depth.

Operations during the past year have been carried on under the project approved July 3, 1902, providing for repairs to and extension of the east jetty and redredging the channel through Calcasieu Lake.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	344,973	137,428	.....
1895.....	254,394	.....	90,579
1896.....	202,755	.....	51,619
1897.....	141,029	.....	61,746
1898.....	190,017	48,988	.....
1899.....	174,651	.....	15,366
Calendar year—			
1899.....	16,829	.....	157,822
1900.....	139,580	122,751	.....
1901.....	139,045	.....	535
1902.....	148,483	9,438	.....

July 1, 1902, balance unexpended	\$75,498.87
June 30, 1903, amount expended during fiscal year	15,212.65
July 1, 1903, balance unexpended	60,286.22
July 1, 1903, amount covered by uncompleted contracts.....	60,000.00
(Amount (estimated) required for completion of existing project.....	242,681.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....	125,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix V 4.)

5. *Johnsons Bayou, Louisiana.*—This stream empties into the Sabine Lake, Texas. Preliminary survey, made in 1897, showed a minimum depth of channel of 12 feet and only 2½ feet over the bar at the mouth of the bayou.

The project of April, 1899, provided for dredging a 6-foot channel through the bar at the mouth of the bayou of such width as the appropriation (\$2,500) would permit.

This work was completed during December, 1899, and a channel 6 feet deep and 60 feet in width secured.

To June 30, 1903, \$2,261.35 has been expended on this improvement. No work had been done since December, 1899.

The stream is navigable for vessels drawing 5 feet of water or less.

Comparative statement of receipts and shipments for four years.

Year ending May 31—	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
1899.....	3,163		
1900.....	3,594	431	
1901.....	4,363	769	
1902.....	2,961		1,412

July 1, 1902, balance unexpended	\$238. 65
July 1, 1903, balance unexpended	238. 65

(See Appendix V 5.)

6. *Removing the water hyacinth, Louisiana and Texas.*—Under the provisions of the sundry civil act of June 4, 1897, a Board of Engineer officers, appointed to investigate the extent of obstruction to navigation in the streams of Florida and Louisiana, and to determine a method of checking the growth of or removing the water hyacinth, recommended the construction of boats fitted with crushing machinery and the use of log booms as adjuncts to the boats. (See Annual Report of the Chief of Engineers for 1899, p. 1615.)

Under the act of March 3, 1899, \$25,000 was appropriated for the purchase of a boat, \$1,000 for the construction of log booms, and \$10,000 for operating expenses.

A boat purchased and fitted with machinery for crushing the hyacinths was operated in Bayou Plaquemine and contiguous streams from July, 1900, to June, 1901, when funds were exhausted. Approximately 188,800 square yards of plants was removed.

A boom with a suitable gate to permit of the plants floating out with the tides, and to prevent their return, was constructed and placed at the mouth of the Bayou Teche, Louisiana.

Act of June 13, 1902, permitting the destruction of the plants by chemical means or otherwise, under a project approved August 4, 1902, the boat was refitted with special machinery designed for spraying the plants with a chemical compound, and operations were carried on in this manner from September, 1902, to May, 1903. Approximately 3,690,662 square yards of plants was sprayed with 356,950 gallons of the Harvesta chemical compound.

Bayou Plaquemine and contiguous streams are at date of this report free from hyacinths, and it is believed that they will so remain for some time before spraying will again be required.

The necessary repairs were made to the log boom at the mouth of the Bayou Teche, Louisiana, during the month of April, 1903.

The river and harbor act approved June 13, 1902, authorized the extension of operations for removal of water hyacinths to include the navigable waters in the State of Texas.

July 1, 1902, balance unexpended	\$7, 484. 46
August 6, 1902, allotted.....	\$18, 000. 00
September 26, 1902, allotted	1, 480. 00
	19, 480. 00
September 30, 1902, amount available	26, 964. 46
June 30, 1903, amount expended during fiscal year	17, 341. 09
July 1, 1903, balance unexpended	9, 623. 37
July 1, 1903, outstanding liabilities	720. 00
July 1, 1903, balance available	8, 903. 37
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	50, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix V 6.)

7. *Mouths of Sabine and Neches rivers, Texas.*—Prior to improvement there was $3\frac{1}{2}$ feet of water over the bar at the mouth of the Sabine River, and 3 feet over the bar at the mouth of the Neches River. Dredging was carried on at the mouth of the Sabine River in 1880 and 1895, and a channel 60 feet wide and 7 feet deep secured. At the mouth of the Neches River dredging was carried on in 1880, 1889, and 1895, and a channel 50 feet wide and 5 feet in depth for a length of 8,000 feet was obtained. Funds were exhausted before deep water in Sabine Lake was reached. In 1897 the channel at the mouth of the Sabine River still afforded a depth of 7 feet, while the channel at the mouth of the Neches River had shoaled to 4 feet.

The act of March 3, 1899, appropriated \$10,000 for improving the mouths of these streams, the appropriation to include the expense of a reexamination of the proposed channel through Sabine Lake by a Board of Engineer officers.

The Board constituted in compliance with this act submitted on August 11, 1899, a report on the proposed channel through Sabine Lake, which report will be found in the Annual Report of the Chief of Engineers for 1900, page 2302.

The project approved July 14, 1899, provided for dredging from deep water in the Neches River to deep water in Sabine Lake. Under this project an 8-foot channel, 7,829 feet long, was dredged from the 7-foot contour in Sabine Lake. A part of the appropriation was expended in deepening the channel across the bar at the mouth of the Sabine River.

Up to June 30, 1903, there had been expended upon this work \$9,925.29, of which \$171.49 was for reexamination of the proposed channel through Sabine Lake.

During the fiscal years 1902 and 1903 no work was done upon these improvements for the reason that the recommendation of the Chief of Engineers dated November 6, 1902, that no work be done for the present, was approved by the Secretary of War.

It is expected that report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

During the calendar year just closed 16 steamers, 3 sailing vessels, and 11 barges, with a maximum draft of 6 feet loaded, and a net registered tonnage of 30,671, carried the commerce, consisting of 145,740 tons of lumber, machinery, fuel, oil, and miscellaneous merchandise, valued at \$510,230, without serious interruption.

July 1, 1902, balance unexpended	\$125,074. 71
July 1, 1903, balance unexpended	125,074. 71

(See Appendix V 7.)

8. *Sabine River, Texas.*—This stream is about 470 miles long, and for the greater part of its length forms the boundary between Texas and Louisiana. It flows into the Gulf of Mexico through Sabine Lake.

Prior to improvement there was a depth of 3½ feet of water over the bar at the mouth of the river. From its mouth to Orange, Tex., there was ample depth. Above Orange the stream was obstructed with snags and logs.

The original project, adopted in 1871 and modified in 1873, provided for deepening the main outlet of the river at a cost of \$18,000.

The project of 1899 provided for the closure of two branches forming Old River, to throw all the water into the "Narrows," and for the removal of obstructions. These projects were completed in December, 1890, and a navigable channel provided for vessels drawing 5 feet for a distance of 30 miles above Orange, Tex.

The project of 1892 provided for the removal of obstructions between Orange, Tex., and Sudduths Bluff, a distance of 50 miles, at an estimated cost of \$10,000. This work was completed in 1895.

On June 30, 1899, the dams built in 1890 were in good condition. The river, from its mouth to Morgans Bluff, a distance of 33 miles, was in fairly good condition, but obstructions had formed between Morgans Bluff and Sudduths Bluff, a distance of 31 miles, since 1895.

With \$2,000 appropriated in 1896 and a like amount in 1899, work of maintenance was carried on between May 17 and July 13, 1900. The river was cleared of obstructions from Morgans Bluff to within 22.5 miles of Sudduths Bluff. Work ceased on account of lack of funds.

The sum of \$52,538.33 was expended up to June 30, 1903, of which \$3,838.33 was expended for maintenance. On June 30, 1902, vessels drawing 5 feet could navigate a distance of 64 miles above the mouth of the river; above Sudduths Bluff, for a distance of about 300 miles, vessels of light draft could run during high water.

No work was done during the fiscal years ending June 30, 1902, and 1903, sufficient funds not being available.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	245,657	99,294	.....
1895.....	182,738	.....	62,919
1896.....	271,257	88,519	.....
1897.....	245,864	.....	25,803
1898.....	276,506	30,142	.....
1899.....	270,642	.....	4,864
Calendar year—			
1899.....	407,372	137,730	.....
1900.....	a 32,148	.....	375,234
1901.....	459,909	427,761	.....
1902.....	413,174	.....	46,735

a Incomplete; full statistics could not be obtained.

July 1, 1902, balance unexpended	\$161.67
July 1, 1903, balance unexpended	161.67

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	1,000.00	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		
(See Appendix V 8.)		

9. *Harbor at Sabine Pass, Tex.*—Prior to improvement there were depths of 18 and 17 feet, respectively, over the two bars in Sabine Pass, opposite the town of Sabine, and opposite Fort Point. These bars were about 200 feet long. Throughout the other portions of the pass the least mean depth was 25 feet.

Beyond the shore line at the entrance to the pass there existed a bar about $3\frac{1}{2}$ miles wide between the interior and exterior 18-foot bottom curves, over which there was not more than 6 feet of water at mean low tide. Channels 12 and 15 feet deep were dredged through this outer bar during 1878 and 1880, under the project of 1873, at a cost of \$325,000, but they soon refilled.

The project of 1882 provided for the construction of parallel jetties at the entrance of the pass 1,800 feet apart and about 4 miles in length from shore line to deep water in the Gulf, and for dredging the channel between these jetties, if necessary. Estimated cost, \$3,177,606.50.

Construction of the jetties began in 1883, and under successive appropriations has been carried on since that date.

The river and harbor act of 1896 authorized contracts for the completion of the project, limiting the cost to \$1,050,000.

Under contract approved June 22, 1897, work was commenced in August, and on August 6, 1900, the east jetty was completed for a length of 21,818 feet; riprap work only was completed for a length of 682 feet, and foundation only for 2,600 feet. The west jetty had a length of 15,560 feet, of which 1,490 feet was only riprap work, and 4,950 feet was foundation only. About 3,000 feet of previous work was capped.

Dredging in the channel was carried on in 1897, 1898, and 1899, the depth being increased to 25 feet and the width to 100 feet. The channel was again dredged in 1900 and 1901, with an allotment of \$8,000 from the emergency appropriation of June 6, 1900.

The act of June, 1897, appropriated \$100,000 for the construction of a dredge (the *Sabine*), which was completed January 14, 1901, and dredging in the channel between the jetties has since been carried on with this dredge. Under the act of March 3, 1899, \$150,000 was appropriated for straightening, widening, and otherwise improving the harbor by the removal of oyster reefs and flats between the United States life-saving station and a point opposite the United States lighthouse. A project covering the proposed work was approved March 27, 1899, and the work completed April 18, 1903.

Act of June 13, 1902, appropriated \$25,000 for widening and straightening the main ship channel and increasing its depth from a point 1,000 feet north of the life-saving station to the entrance of the Port Arthur Canal, in accordance with report published in the Annual Report of the Chief of Engineers for 1901, page 1915. Under a project approved July 3, 1902, this work was completed February 27, 1903, and the channel depth was increased to 25 feet at mean low water for an average width of 400 feet.

The storm of September 8, 1900, damaged the jetties at the entrance to the pass (see Annual Report, Chief of Engineers, 1901, p. 1919), and under a project approved July 3, 1902, a contract for the expenditure of \$100,000, appropriated by act of June 13, 1902, was entered into November 15, 1902, but at date of this report no work had yet been commenced. On June 30, 1903, there was a navigable depth of 21.5 feet in the channel between the jetties, and in the main ship channel there was not less than 26 feet of water at mean low tide.

To this date \$325,000 had been expended on these improvements under previous projects, and \$3,156,059.21 under the present project, making a total of \$3,481,059.21, of which amount \$38,767.13 was for maintenance of the jetty channel since November 28, 1900, and \$72,194.53 was for dredging in the harbor under the project of 1899.

During the past fiscal year dredging was carried on under contract from August, 1902, to April, 1903. There was removed under this contract, 1,423,164 cubic yards of material, resulting in an available depth at mean low water of 26 feet through a channel averaging 600 feet in width. Under a project approved July 3, 1902, dredging was also carried on under contract from a point 1,000 feet north of the life-saving station to the entrance of the Port Arthur Canal, and a channel averaging 150 feet in width, with a depth of 30 feet at mean low water, secured.

At the close of the fiscal year ending June 30, 1902, the jetty channel had shoaled to an average depth of 21.5 feet. Dredging was carried on with the dredge *Sabine* from February 17, 1902, to September 15, 1902, with funds advanced by the Kansas City Southern Railway Company. From the latter date to April 2, 1903, the *Sabine* was operated with the funds appropriated under act of June 13, 1902, under a project approved July 3, 1902. At date of this report there is an available depth throughout the jetty channel of 21.5 feet, and an average width of channel of about 150 feet. Under orders from the Chief of Engineers the dredge *Sabine* was sent to do emergency work in South Pass of the Mississippi River on April 3, 1903, and at date of this report had not yet returned to Sabine Pass.

A contract for the repairs to and extension of the east jetty was approved November 15, 1902, but this work had not been commenced at the end of the past year.

A survey was made of the harbor for the purpose of reestablishing the harbor lines.

Additional work should be done toward building the jetties to full height of mean high-water level in order that the full benefits of the improvement may be obtained. It is estimated that \$1,016,573 will be required to complete the jetties in accordance with the original project.

Comparative statement of receipts and shipments for ten years.

	Tons.	Change in tonnage from previous year.	
		Increase.	Decrease.
Year ending May 31—			
1894.....	40,966	25,916	
1895.....	47,691	6,725	
1896.....	48,886	1,195	
1897.....	87,682	38,746	
1898.....	238,400	150,768	
1899.....	326,982	80,582	
Calendar year—			
1899.....	326,494		488
1900.....	217,489		109,005
1901.....	150,087		67,402
1902.....	689,688	539,601	

July 1, 1902, balance unexpended.....	\$261,553.77
June 30, 1903, amount expended during fiscal year.....	119,160.01

July 1, 1903, balance unexpended.....	142,393.76
July 1, 1903, amount covered by uncompleted contracts.....	100,000.00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	300,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix V 9.)

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN TEXAS.

This district was in the charge of Capt. C. S. Riché, Corps of Engineers. Division Engineer, Lieut. Col. H. M. Adams, Corps of Engineers.

1. *Galveston Harbor, Texas.*—Galveston Harbor embraces an anchorage area of over 1,960 acres, of which 1,500 acres has a depth of more than 20 feet and 460 acres has a depth of more than 30 feet. It affords vessels excellent shelter from storms. Waterways connect it with Houston and with Brazos River.

The entrance to this harbor was originally obstructed by two bars, known as the inner and outer. The natural depth on the inner bar was about 9½ feet and on the outer bar about 12 feet. These shallow depths prevented all but the lightest-draft vessels from using the harbor and necessitated the lighterage of cargoes to the larger vessels anchored in the deep water beyond the outer bar.

Prior to 1874 the projects for improving this harbor related to dredging operations on a small scale, and were expected to afford only temporary relief to navigation.

The project for the permanent improvement of this harbor by jetties was adopted in 1874 and modified in 1880 and 1886. It was

expected that upon their completion a least depth of 25 feet would be obtained on the outer bar. (See Annual Report of the Chief of Engineers for 1880, p. 1221 et seq.)

The 1886 project provided for a possible depth of 30 feet by constructing jetties to a height of 5 feet above mean low tide and extending them to the 30-foot contour in the Gulf and supplementing the action of the tidal scour by dredging. The estimated cost of this revised project was \$7,000,000.

The expenditures under the above projects resulted in a depth of 26 feet at mean low tide on the outer bar, an increase of 14 feet since work began, and a depth of 26 feet at mean low tide on the inner bar, an increase of 16 feet during the same period. This increased depth of water enabled vessels to load to their full capacity at the Galveston wharves, thereby making the lighterage of cargoes no longer necessary.

Prior to the hurricane of September 8, 1900, the completed south jetty extended 35,603 feet, and the completed north jetty extended 25,907 feet.

The hurricane of September 8, 1900, damaged the jetties to a considerable extent, and a report of a Board of Engineers, showing the effect of this hurricane on the jetties and the main ship channel, with an estimate for repairing same, at a cost of \$1,500,000, is contained in House Document No. 134, Fifty-sixth Congress, second session, and reprinted in the Annual Report of the Chief of Engineers, page 2018.

The river and harbor act of June 13, 1902, contains the following item:

Improving Galveston Harbor, Texas, by maintaining the entrance to said harbor and toward the restoration of the jetties in accordance with the report submitted in House Document Numbered One hundred and thirty-four, Fifty-sixth Congress, second session, three hundred and fifty thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary in prosecuting the project of repairing, restoring, and completing the jetties as recommended in the said report, not to exceed four hundred thousand dollars, exclusive of the amounts herein and heretofore appropriated: *Provided further*, That appropriations heretofore made and unexpended for Galveston Harbor are hereby made available for the above purposes. The Secretary of War is authorized to modify the plan for the south jetty so as to connect and adjust the same with the protection work proposed by the city of Galveston, if found advisable.

Repairs to the jetties have been begun.

The U. S. dredge *Gen. C. B. Comstock* continued operations during the fiscal year, maintaining, strengthening, and widening the channel between the jetties.

The depth of water on the outer bar at the close of the fiscal year is 27½ feet, an increase of 1½ feet since survey of June, 1902. The depth on the inner bar remains practically the same as at end of preceding fiscal year.

The river and harbor act of June 13, 1902, authorized and directed the Secretary of War to appoint a Board of Engineers to make an examination and prepare plans and estimates for the protection of the port of Galveston and the property of the United States on Galveston Island from excessive storms, by a breakwater or other means, and to submit the same, with report upon the feasibility, advisability, and cost thereof, and the probable effect of such improvement on the general condition of the port and its commerce. The report of the Board, dated December 19, 1902, is submitted herewith as Appendix W 13.

Commerce has been greatly benefited by the improvement of this harbor, as shown by the increased size and tonnage of the vessels using the port. The amount of freight handled during the fiscal year was 3,552,717 tons.

The total amount of commerce transported to and from Galveston during the fiscal year was: Cotton and cotton products, 796,538 tons; ore, 42,687 tons; wool, 17,850 tons; grain, 615,371 tons; sugar, 100,378 tons; coal, 49,316 tons; general merchandise, 459,402 tons; flour, 40,328 tons; lumber and manufactures of wood, 81,999 tons; cement, 53,681 tons; petroleum, 1,252,561 tons; manufactures of iron and steel, 36,815 tons; cattle and other animals, 5,791 tons.

The amount expended to June 30, 1903, was \$8,609,097.22, of which \$125,526.97 was for maintenance of the improvement, with an additional sum of \$100,000 subscribed by the city of Galveston in 1883. Of this amount, \$1,478,000 was expended previous to 1886.

July 1, 1902, balance unexpended	\$359,335.41
Amount appropriated by sundry civil act approved March 3, 1903.....	300,000.00
Proceeds of sale of condemned property.....	53.14
Transfer of tug "Anna"	10,000.00
June 30, 1903, amount expended during fiscal year	669,388.55
July 1, 1903, balance unexpended	89,412.80
July 1, 1903, balance unexpended	579,975.75
July 1, 1903, outstanding liabilities.....	7,810.56
July 1, 1903, balance available	572,165.19
July 1, 1903, amount covered by uncompleted contracts.....	512,050.00
(Amount (estimated) required for completion of existing project.....	850,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July, 1903.....	450,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W 1.)

2. *Galveston channel, Texas.*—This is the channel passing along the wharf front of the city and connecting the same with the jettied entrance channel.

The river and harbor act approved June 13, 1902, provides as follows:

Improving Galveston channel in accordance with the report submitted in House Document Numbered Two hundred and sixty-four, Fifty-sixth Congress, second session, one hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to prosecute said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred thousand dollars, exclusive of the amounts herein appropriated: *Provided further*, That the amounts herein appropriated or authorized shall be expended in obtaining a channel from the outer end of the inner bar to Fifty-first street, thirty feet in depth, and of such width in the respective portions thereof as shall best subserve the interests of commerce.

Total amount expended on this improvement in dredging and dike construction to June 30, 1903, was \$38,897.31.

For commercial statistics see report on improvement of Galveston Harbor.

^aOf this amount \$100,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

July 1, 1902, balance unexpended	\$100,000.00
Amount appropriated by sundry civil act approved March 3, 1903	200,000.00
June 30, 1903, amount expended during fiscal year	300,000.00
July 1, 1903, balance unexpended	261,102.69
July 1, 1903, outstanding liabilities	6,569.35
July 1, 1903, balance available.....	254,533.34
July 1, 1903, amount covered by uncompleted contracts.....	192,195.57
{ Amount (estimated) required for completion of existing project.....	1,285,000.00
{ Amount that can be profitably expended in fiscal year ending June	
30, 1905, in addition to the balance available July 1, 1903.....	150,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

(See Appendix W 2.)

3. *Channel from Galveston Harbor to Texas City, Tex.*—This channel is designed to afford a channel 100 feet wide at bottom and 25 feet deep, north of Pelican Island, from Galveston Harbor to Texas City, Tex. The natural depth on the line of the proposed channel is from 4 to 8 feet. During 1895 and 1896 a channel 16 feet deep was dredged by the Texas City Terminal Company. No work having been done since then, it had at the beginning of present operations shoaled nearly to its natural depth.

Work is now in progress under a contract made in January, 1900.

During the fiscal year contractors completed according to contract 16 sections of 1,000 feet each to a depth of 25 feet and 100 feet wide at bottom, and were paid for same \$200,000. No further payment is to be made under this contract until the entire length of channel is dredged to a depth of 25 feet and 100 feet wide at bottom.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

Total amount expended on this improvement to June 30, 1903, \$200,000 from appropriation by Congress and \$2,370.56 from amount deposited by contractors for expenses of superintendence, inspection, etc.

DEPOSIT OF CONTRACTORS.

July 1, 1902, balance unexpended	\$3,048.15
June 30, 1903, amount expended during fiscal year	418.71
July 1, 1903, balance unexpended	2,629.44

IMPROVEMENT.

July 1, 1902, balance unexpended	250,000.00
June 30, 1903, amount expended during fiscal year	200,000.00
July 1, 1903, balance unexpended	50,000.00
July 1, 1903, amount covered by uncompleted contracts.....	50,000.00

(See Appendix W 3.)

4. *Galveston ship channel and Buffalo Bayou, Texas.*—These improvements have heretofore been reported on individually under the headings of "Ship channel in Galveston Bay, Texas," and "Buffalo Bayou, Texas." The river and harbor act of March 3, 1899, combined the work under one item.

The ship channel in Galveston Bay and Buffalo Bayou are two links in the waterway connecting Houston with deep water in Galveston Bay, the other links being the San Jacinto River and the Morgan Canal.

In their natural state these two waterways had a depth of from 4 to 8½ feet. The earlier projects for their improvement provided for a channel 100 feet wide and 12 feet deep. Dredging was carried on for a number of years, furnishing a channel sufficient for the character of vessels heretofore navigating these channels.

In 1892 the Government purchased the Morgan Cut and Canal, 5.43 miles long, from the Buffalo Bayou Ship Channel Company for the sum of \$92,316.85.

In 1897 a Board of Engineers submitted a project (see H. Doc. No. 99, 56th Cong., 2d sess.; also Appendix V 9, p. 1515, Annual Report of the Chief of Engineers for 1898) providing for a water channel not less than 25 feet deep and 100 feet wide extending from the mouth of the jetties at the city of Galveston through the existing ship channel and up Buffalo Bayou to the city of Houston, Tex., and for a harbor at or near Houston of a depth of not less than 25 feet and of a width of 500 feet.

The Board was of the opinion that in the first division of this water route (through Galveston Bay, including the Morgan Canal) the width of the channel should be 150 feet, with slopes such as the material may assume, varying from 1 on 2 to 1 on 4. For the second division (from north end of Morgan Canal to Harrisburg) the Board recommended a width of channel limited to 100 feet. In the third division (between Harrisburg and Houston) the removal of at least one bend by a cut-off would be required, and the straightening and widening of others were proposed. It was also proposed to remove the point just below the San Antonio and Aransas Pass bridge, and to widen the channel at the mouth of White Oak Bayou in Houston.

The cost of the work was estimated by the Board as follows:

First division, including construction of two suction dredges.....	\$1, 100, 000
Second division	900, 000
Third division	1, 700, 000
Administration and contingencies	300, 000
Making a total of.....	4, 000, 000

The estimated cost of maintenance was \$100,000 annually.

The work under way at close of past fiscal year consisted in dredging a channel 70 feet wide and 17 feet deep from deep water in Galveston Harbor, through Galveston Bay and Morgan Cut (division 1), and constructing pile and brush dike from Morgan Cut to Redfish bar.

During the past fiscal year active operations were carried on under contract with Charles Clarke & Co., of Galveston, Tex., to December 10, 1902, when contract was completed. Under this contract a channel was dredged to a depth of 17 feet and 70 feet wide through division 1, and pile and brush dike from Morgan Canal to Redfish bar completed in same division.

The river and harbor act of June 13, 1902, contained the following item:

Galveston ship channel and Buffalo Bayou, Texas: Continuing improvement, three hundred thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be required to prosecute said improvement, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate seven hundred thousand dollars, exclusive of

the amounts herein and heretofore appropriated. The amounts herein appropriated and authorized shall be expended in developing the proposed channel in divisions one and two to a uniform depth: *Provided further*, That not more than one-half of said amounts shall be expended upon division two.

Contract for work under this act was entered into on February 9, 1903, with the Bowers Southern Dredging Company, of Galveston, Tex. Active operations were being carried on at close of fiscal year by the contractors.

The amounts expended on these channels to June 30, 1903, are as follows:

Ship channel in Galveston Bay, including purchase of Morgan Cut and Canal (\$92, 316. 85)	\$849, 016. 85
Buffalo Bayou, Texas	228, 750. 00
Galveston ship channel and Buffalo Bayou, Texas	355, 916. 43
Total	1, 433, 683. 28

The only commercial statistics that could be obtained for the fiscal year were those covering freight carried by the Houston Direct Navigation Company, which amounted to 109,704 tons, of which 91,289 tons was cotton, 128 tons was cotton products, 1,345 tons was lumber, 953 tons was bank sand, 8,497 tons was reef shell, 28 tons was cement, 4,447 tons was San Jacinto sand, 219 tons was green coffee, 1,375 tons was cotton bagging, 99 tons was roofing slate, 1,309 tons was piling, and 15 tons was plaster.

For number of vessels and tonnage passing through Morgan Canal see report on operating and care of Morgan Canal, Appendix W 5 of this report.

July 1, 1902, balance unexpended	\$375, 124. 60
Amount appropriated by sundry civil act approved March 3, 1903	500, 000. 00
Proceeds of sales of condemned property	. 04
July 1, 1903, balance unexpended	875, 124. 64
June 30, 1903, amount expended during fiscal year	131, 041. 03
July 1, 1903, balance unexpended	744, 083. 61
July 1, 1903, outstanding liabilities	13, 695. 46
July 1, 1903, balance available	730, 388. 15
July 1, 1903, amount covered by uncompleted contracts	603, 778. 49
{ Amount (estimated) required for completion of existing project	2, 900, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	" 500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W 4.)

5. *Operating and care of Morgan Canal, Texas.*—A watchman was stationed at the canal during the past fiscal year and repairs to bulk-head of canal were completed.

A statement contained in the report of the local engineer officer shows the items of expenditure, which amounted to \$4,965.45.

(See Appendix W 5.)

^a Of this amount \$200,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

6. *Trinity River, Texas.*—The river and harbor act approved June 13, 1902, provides as follows:

Improving Trinity River, Texas, in accordance with the report submitted in House Document Numbered Four hundred and nine, Fifty-sixth Congress, first session, one hundred and twenty-five thousand dollars: *Provided*, That the Secretary of War may enter into a contract or contracts for materials and work to prosecute the project recommended in said report, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and seventy-five thousand dollars, exclusive of the amount herein appropriated: *Provided further*, That three hundred and fifty thousand dollars of the amounts herein appropriated and authorized shall be expended to construct locks and dams upon the river between the mouth and section one in those places where the most serious obstructions exist, and to procure and operate snag boats, and clear the river with the purpose of permitting through navigation over the portion above described; and the sum of fifty thousand dollars of the amount herein appropriated shall be expended for the purpose of securing open channel navigation in section one of said river, and a board of engineers shall be designated by the Secretary of War to examine section one of said river as described in said House document, and report upon the feasibility and advisability of expending the further sum of three hundred and fifty thousand dollars with a view to securing not less than eight months' navigation annually upon the said section one to Dallas.

During the past fiscal year a snag boat and quarter boat was constructed at Dallas, Tex., and the cleaning of the river has been begun.

It is expected that the report of the Board of Engineers provided for in the item of the act above quoted will be submitted to Congress in December, 1903.

Total amount expended on this improvement to June 30, 1903, \$29,276.11.

No-commercial statistics for the fiscal year could be obtained.

See also report on this stream under heading for improving Brazos River, between Velasco and Richmond, etc., page 355.

July 1, 1902, balance unexpended	\$125,000.00
Amount appropriated by sundry civil act approved March 3, 1903	250,000.00
	375,000.00
June 30, 1903, amount expended during fiscal year	29,276.11
July 1, 1903, balance unexpended	345,723.89
July 1, 1903, outstanding liabilities	5,923.76
July 1, 1903, balance available	339,800.13
{ Amount (estimated) required for completion of existing project	4,175,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W 6.)

7. *Brazos River between Velasco and Richmond, West Galveston Bay channel, Double Bayou, and the mouths of adjacent streams, Texas, including Trinity River and Cedar Bayou.*—The river and harbor act approved March 3, 1889, provides as follows:

For the improvement of the Brazos River between Velasco and Richmond, West Galveston Bay channel, Double Bayou, and the mouths of adjacent streams, sixty-five thousand dollars, out of which said sum a suitable dredge and snagging outfit may be provided to carry on said work and to be used on other approved projects on the Texas coast, including streams emptying into the Gulf of Mexico and bays connected therewith.

Therefore the projects embraced in this improvement had been independent. (See Brazos River, between Velasco and Richmond, Annual Reports of the Chief of Engineers for 1895, p. 1838 et seq., and for 1900, p. 2444; channel of West Galveston Bay, Annual Report of the Chief of Engineers for 1892, p. 1566 et seq., and Double Bayou, Annual Report of the Chief of Engineers for 1898, p. 287 et seq.)

The object of this improvement, in part, is to obtain and maintain a navigable channel depth of from 4 to 6 feet across the bars at the mouths of a number of the streams and bayous along the Texas coast by dredging and snagging, the plant to be owned and operated by the United States.

The improvement is intended to develop a light-draft inland navigation tributary to Galveston and other Texas harbors which will afford cheap transportation by light-draft steamers and barges to the fertile coast country of Texas.

The river and harbor act approved June 13, 1902, appropriated \$50,000 for this improvement, \$30,000 of which may be expended in the purchase of the canal from West Galveston Bay to the mouth of the Brazos River, known as the Galveston and Brazos Canal. During the past year this canal was purchased and paid for.

During the past fiscal year the dredge *Gen. H. M. Robert* was completed and put in commission at Double Bayou, Texas; 13,304.82 cubic yards of material was excavated from the channel leading into the bayou. Owing to the encountering of heavy clay, which could not be excavated by the dredge without the aid of a new suction head or mechanical cutter, operations had to be suspended until a new suction head could be secured.

The channel across Hannas reef (Ladies Pass), connecting lower Galveston Bay, East Bay, and East Bay Bayou, was dredged to a depth of 7 feet, and 45 to 60 feet wide.

The amount expended on this improvement to June 30, 1903, was \$102,049.85.

No commercial statistics for the fiscal year could be obtained.

July 1, 1902, balance unexpended	\$59,068.41
June 30, 1903, amount expended during fiscal year	46,118.26

July 1, 1903, balance unexpended	12,950.15
July 1, 1903, outstanding liabilities	35.00

July 1, 1903, balance available	12,915.15
---------------------------------------	-----------

{ Amount (estimated) required for completion of existing project	130,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(a) *Trinity River*.—The improvement of this stream has heretofore been limited to that portion lying between the mouth and Liberty, at the head of tide water, a distance of 39 miles. The river empties into Galveston Bay through several mouths or passes, opposite each of which a bar existed on which the depth of water did not exceed 3½ feet at mean low tide.

The project adopted for this improvement on June 18, 1878, consisted in the removal of snags from the river below Liberty and in

dredging a channel 80 feet wide by 6 feet deep across the bar at the mouth of the pass then in use by vessels. The estimated cost of the work was \$22,581.40. (See Annual Report of the Chief of Engineers for 1873, p. 685 et seq.) On May 4, 1889, an amended project was adopted. It contemplated the erection of two parallel jetties at the mouth known as the Middle Pass, placed about 275 feet apart and extending about 7,750 feet into Galveston Bay; also in closing the other two principal passes by submerged dams, the object being to create and maintain a channel 6 feet deep at mean low tide at the mouth of the river. The revised cost of the improvement was placed at \$89,500. (See Annual Report of the Chief of Engineers for 1889, p. 1557 et seq.)

Under the project of May 4, 1899, the west jetty was completed, its length being 7,359 feet, and a channel 100 feet wide by 5 feet deep was secured.

The dredge *Gen. H. M. Robert* during the fiscal year removed from the Main Pass all snags, 700 feet of old bulkhead, and dredged about 3,100 feet of the pass to a depth of 8 feet and 75 feet wide.

For report upon improving this river, under a new and enlarged project, see page 354.

The amount expended on this improvement to June 30, 1903, was \$84,000.

The total amount of freight carried during the fiscal year was 20 tons charcoal, 200 head cattle, 16,000 tons lumber, 1,500 cords wood, and 3,750 tons general merchandise.

July 1, 1902, balance unexpended	\$6,750.63
June 30, 1903, amount expended during fiscal year.....	6,750.63

(b) *Cedar Bayou*.—For projects and work done by the United States Government at Cedar Bayou, Texas, see Annual Report of the Chief of Engineers for 1895, page 1815, Appendix T 5.

The river and harbor act approved June 13, 1902, provides as follows:

Improving Cedar Bayou, Texas: Maintaining improvement, five thousand dollars: *Provided*, That the dredge constructed for use in this locality shall be available for this work.

No work was done up to the close of the past fiscal year.

The amount expended on this improvement to June 30, 1903, was \$32,150.

July 1, 1902, balance unexpended	\$5,000
July 1, 1903, balance unexpended	5,000

(c) *Channel in West Galveston Bay*.—West Galveston Bay is a body of water covering about 39 square miles, and lies between Galveston Island and the mainland. It extends from Galveston Bay to the west end of Oyster Bay, and is connected with the Gulf of Mexico by San Luis Pass, at the western extremity of Galveston Island, and with the Brazos River by the Galveston and Brazos Canal. The natural depth of the bay was from 2½ to 3 feet.

The project for improving the bay was adopted July 13, 1892, and proposed widening, deepening, and straightening the channel, so as to give a width of 200 feet and a least depth of 3½ feet from Galveston Bay to San Luis Pass, and a channel 100 feet wide and 3 feet deep along Christmas Point in Oyster Bay, both channels to be properly defined by beacons. The estimated cost of the improvement was

\$28,998.80. (See Annual Report of the Chief of Engineers for 1892, p. 1556 et seq.) On July 8, 1896, authority was given to modify the project so as to afford a depth of 5 feet instead of 3½ feet, provided the cost of the work should not be increased.

The amount expended to June 30, 1903, was \$19,775.97.

This expenditure resulted in an unobstructed channel 100 feet wide and from 3 to 3½ feet deep from Galveston Bay to the Galveston and Brazos Canal. Beacons were also erected to define the channel.

No work was done during the past fiscal year.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

July 1, 1902, balance unexpended	\$5, 224. 03
July 1, 1903, balance unexpended	5, 224. 03

(d) *Brazos River*.—This improvement is at present limited to that portion of the river lying between Richmond and Velasco, a distance of about 89 miles. Its low-water level is affected by the Gulf tide as far up as Bolivar Landing, 40 miles above Velasco. The course of the river is tortuous, and the channel was obstructed by shoals and snags.

The project for improvement was adopted June 3, 1896, and proposed the removal of snags and overhanging trees. It was estimated that \$10,000 would put this portion of the river in good navigable condition at ordinary stages, and that an annual expenditure of \$2,500 would keep it in this condition. (See Annual Report of the Chief of Engineers for 1895, p. 1838 et seq.)

No work has been done under this project.

The amount expended on this improvement to June 30, 1903, was \$22.35.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

July 1, 1902, balance unexpended	\$4, 977. 65
July 1, 1903, balance unexpended	4, 977. 65

(See Appendix W 7.)

8. *Brazos River, Texas, from Richmond to Old Washington*.—The river and harbor act approved June 13, 1902, provides as follows:

Improving Brazos River, Texas, from Richmond to Old Washington, in accordance with the second plan of the report submitted in House Document Numbered Two hundred and eighty-three, Fifty-sixth Congress, second session, one hundred and fifty thousand dollars.

The plan referred to is printed in the Annual Report of the Chief of Engineers for 1901, page 1974 et seq., and contemplates improvement of the river by open-channel work between the mouth and Old Washington, at a cost of \$225,000, but the act limits the improvement to that portion of the river between Richmond and Old Washington, the estimated cost of this latter work being \$200,000.

The approved project for the expenditure of the available funds consists in removing snags and overhanging trees and in narrowing the river at its shoals by spur dikes.

At the close of the fiscal year plant was under construction at Old Washington, Tex., and nearly ready for work.

The amount expended on this improvement to June 30, 1903, was \$12,066.92.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

July 1, 1902, balance unexpended	\$150,000.00
June 30, 1903, amount expended during fiscal year	12,066.92
July 1, 1903, balance unexpended	137,933.08
July 1, 1903, outstanding liabilities	3,554.12
July 1, 1903, balance available	134,378.96
{ Amount (estimated) required for completion of existing project	50,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W 8.)

9. *Mouth of Brazos River, Texas.*—The improvement of the mouth of this stream was at first undertaken by the Brazos River Channel and Dock Company, which partially constructed a system of parallel jetties.

The river and harbor act approved March 3, 1899, contains the following item:

Mouth of Brazos River, Texas: For dredging, and such other work as may be deemed most effective in the judgment of the Secretary of War in improving and developing the harbor, eighty-five thousand dollars: *Provided*, That no part of said sum shall be expended until the Brazos River Channel and Dock Company shall file with the Secretary of War a transfer to the United States of the jetties, and auxiliary works; also a release of all rights and privileges conferred upon said company by its charter or by the act of Congress approved August ninth, eighteen hundred and eighty-eight, to charge or collect tolls for the use and navigation of said river; and the Secretary of War is directed to have an examination made of the mouth of the Brazos and the jetties, and report to Congress the estimated cost of extending the jetties one-half mile, and the estimated depth and width of the channel to be obtained by such extension, and the estimated cost of obtaining twenty feet of water and a channel one hundred and fifty feet wide.

Under date of April 25, 1899, the Brazos River Channel and Dock Company filed with the Secretary of War a transfer to the United States of these jetties and auxiliary works, also a release of all rights and privileges conferred upon the said company by its charter or by the act of Congress approved August 9, 1888, to charge or collect tolls for the use and navigation of the river.

The proposed work at this locality consists in putting the present jetties at the mouth of the river in a fair condition to resist the effects of storms and to protect a dredge while working between them; also to make a beginning in the construction of spur dikes to narrow the channel between the jetties, and to dredge a channel as far up as the light-house to a depth of 18 feet at mean low tide and 150 feet wide.

The condition of the jetties before and after the hurricane of September 8, 1900, is given in the Annual Report of the Chief of Engineers for 1901, page 1940 et seq.

The estimate for completion of existing project has been increased by \$175,000, the amount estimated by Board of Engineers to be necessary for repair of damages by the hurricane of September 8, 1900. The report of the Board is printed in House Document No. 133, Fifty-sixth Congress, second session.

The river and harbor act approved June 13, 1902, appropriated \$50,000 for continuing the improvement.

The approved project for expenditure of this appropriation consists in reinforcing the shore end of the north jetty in such manner as to render unlikely any flanking of the jetty by the river, and filling in the most serious gaps in the jetties.

At the close of the fiscal year contract had been entered into for this work, but no work had been done by the contractor.

The amount expended on this improvement to June 30, 1903, was \$230,953.77.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

July 1, 1902, balance unexpended	\$63, 127. 44
Proceeds of sale of condemned property.....	8. 63
	63, 136. 07
June 30, 1903, amount expended during fiscal year	331. 21
July 1, 1903, balance unexpended	62, 804. 86
July 1, 1903, amount covered by uncompleted contracts.....	50, 790. 00
{ Amount (estimated) required for completion of existing project	275, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	100, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W 9.)

10. *Aransas Pass, Tex.*—Aransas Pass is on the south coast of Texas, 175 miles southwest of Galveston and 125 miles north of the Rio Grande, and is the outlet of Aransas Bay to the Gulf of Mexico. The area of the bay is about 80 square miles. It is connected with Corpus Christi Bay on one side and with the shallow bays of Mosquito, St. Charles, and Copano on the other.

For projects and work done by the United States Government and private corporations at Aransas Pass see Annual Report of the Chief of Engineers for 1898, page 1527 et seq.

The river and harbor act of March 3, 1899, contains the following item:

Improving Aransas Pass, Texas: For dredging and other improvement of Aransas Pass Harbor, sixty thousand dollars: *Provided*, That the Secretary of War is hereby authorized to contract for the removal of that portion of the old Government jetty in said harbor from the end nearest the curved jetty constructed by the Aransas Pass Harbor Company to the wreck *Mary*, in such manner as to in nowise interfere with the curved jetty now located in said harbor: *And provided further*, That said contract shall not be let by the Secretary of War, nor said work done, until the said Aransas Pass Harbor Company shall have properly released and surrendered all rights and privileges heretofore granted to it in said harbor by Congress, also the jetty constructed in said harbor.

The Aransas Pass Harbor Company, under date of March 27, 1899, released and surrendered all rights and privileges heretofore granted to it in Aransas Pass Harbor by Congress, also the jetties constructed in said harbor.

For condition of the jetties and pass at the time the works were surrendered to the United States see map accompanying Annual Report of the Chief of Engineers for 1900, page 2336.

With the funds appropriated by the river and harbor act of March 3, 1899, 1,300 feet of jetty was completed.

The river and harbor act of June 13, 1902, contains the following item:

Improving Aransas Pass, Texas: Continuing improvement, two hundred and fifty thousand dollars: *Provided*, That the work at this harbor shall be confined to the completion of the north jetty in accordance with the design and specifications of the Aransas Pass Harbor Company, and in continuation of the work heretofore carried out on said jetty by said company, and to such additional work as may be necessary for strengthening such jetty, and for the removal of such part of the old Government jetty and any other hard material which may interfere with the formation of a channel by the natural action of the currents.

The approved project for expenditure of available funds under this act consists in strengthening and completing the north jetty and removing such portion of the old Government jetty and any hard material which may interfere with the formation of a channel by the natural action of the currents.

At the close of the fiscal year contracts had been entered into for strengthening and completing the north jetty and removing the old Government jetty, but no work had been done by the contractors.

The amount expended on this improvement to June 30, 1903, was \$637,627.91, exclusive of \$9,938.93 subscribed by the citizens of Rockport and Corpus Christi.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

July 1, 1902, balance unexpended	\$255,589.08
June 30, 1903, amount expended during fiscal year	1,966.99

July 1, 1903, balance unexpended	253,622.09
July 1, 1903, amount covered by uncompleted contracts.....	246,000.00

{ Amount (estimated) required for completion of existing project	1,430,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W 10.)

11. *Harbor at Brazos Santiago, Tex.*—No work has been done on this improvement since 1884. This work was dropped from the list of improvements in the Galveston district in December, 1895, and the available balance returned to the Treasury.

Owing to the shoaling of the bar, practically cutting off all water communication, authority was secured to use the balance, \$57,476. remaining in the Treasury, it being the intention to dredge a channel over the bar to give temporary relief to the locality.

No work was attempted during the fiscal year.

The amount expended on this improvement to June 30, 1903, was \$192,663.16.

No commercial statistics for the fiscal year ending June 30, 1903, could be obtained.

July 1, 1902, balance unexpended	\$54,836.84
July 1, 1903, balance unexpended	54,836.84

(See Appendix W 11.)

12. *Removing sunken vessels or craft obstructing or endangering navigation.*—During the hurricane which visited Galveston September 8, 1900, a great many barges, schooners, etc., and one steam vessel were

wrecked and sunk in Galveston Bay and vicinity, and same have become a menace to navigation.

At the beginning of the past fiscal year contract had been entered into for removing the following wrecks: Dredge No. 3, barge No. 3, a dredge boat, and flatboat *Daisy*, and contractor was engaged in removing wreck of dredge No. 3.

The wrecks were completely removed by September 16, 1902.

The total cost of removing these wrecks was \$2,637.08, of which \$122.19 was expended in the fiscal year 1902. A statement contained in the report of the local engineer officer shows the items of expenditure.

(See Appendix W 12.)

WESTERN RIVERS.

IMPROVEMENT OF CERTAIN RIVERS AND WATERWAYS IN LOUISIANA, TEXAS, ARKANSAS, INDIAN TERRITORY, AND MISSISSIPPI TRIBUTARY TO MISSISSIPPI RIVER.

This district was in the charge of Capt. Chas. L. Potter, Corps of Engineers, to June 5, 1903, and in the temporary charge of Capt. Chas. S. Bromwell, Corps of Engineers, since that date. Division Engineer, Lieut. Col. H. M. Adams, Corps of Engineers.

1. *Red River, Louisiana, Arkansas, Texas, and Indian Territory.*—This improvement was undertaken by the United States in 1828, and between 1828 and 1841 more than \$425,000 was appropriated by Congress for the removal of the great Red River raft. When the General Government commenced the work the raft was 92 miles long, extending from Loggy Bayou, 65 miles below Shreveport, La., to Hurricane Bluffs, 27 miles above. A channel was opened through this obstruction, but, owing to the failure of appropriations between 1841 and 1852, additional raft formed between Carolina and Coushatta bluffs, a distance of 12 miles. In 1852, \$100,000 was appropriated, and in 1857 the agent in charge of the work reported the route opened, though not completed, and recommendation was made for appropriations of \$50,000 a year for completion and maintenance. The total amount expended from 1828 to 1857 was \$532,219.90. Nothing was done during the succeeding fifteen years, and in that long interval the results of much of the former work were lost.

When work was resumed in 1872 the river was closed by the raft above Shreveport, La., then 32 miles long and growing constantly. Below Shreveport the enlargement of the outlet through Tones Bayou was depleting the main channel and threatening its closure to navigation. At Alexandria, La., the falls were impassable at low stages. Navigation was difficult and dangerous at all places and at all times, on account of the great number and the constant additions of snags, stumps, sunken logs, and leaning trees, and the wrecks of more than 200 steamboats lay in the channel between the mouth and the head of navigation. The channel shifted frequently, and during floods the river overflowed the entire raft region, creating a network of streams and drains, some of which remained navigable at high stages. Both above and below Shreveport the bed of the river was a mass of sunken logs and stumps, portions of which were constantly scouring loose, while those embedded or thoroughly water-logged remained to cause

sediment deposits and to form bars impassable at low stages. The banks were heavily timbered and each flood caused them to cave or slide, contributing enormous quantities of drift and exposing shore snags which projected far out into the river.

The project entered upon in 1872 contemplated opening navigation through the raft above Shreveport and closing Tones Bayou Outlet. Under river and harbor act of 1878 the removal of wrecks, snags, and other obstructions to navigation below Shreveport was commenced, and the act of 1879 authorized the same kind of work above head of the raft to Fulton, Ark. These works were continued under three separate and distinct titles of appropriation until 1882, when they were combined by the river and harbor act of that year in a general appropriation for continuing the improvement from Fulton, Ark., to the Atchafalaya River, Louisiana, with a provision for work at Alexandria, La. The river and harbor acts of 1886 to 1896 made separate appropriations for snagging work, etc., above Fulton, Ark., to the mouth of Kiamichi River, Indian Territory, which was added to the general project by act of 1899. The acts of 1884 and 1890 contained provisions for closing the Sale and Murphy Outlet, Louisiana; the acts of 1888, 1892, and 1894, authorized expenditures for the improvement of Cypress Bayou, Bayou Dorcheat, and Sulphur River, tributaries of Red River, and the act of 1902 provided for improvement of the channel at Shreveport, La.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplates the systematic clearing of the banks, to remove the source of drift and snags; continuing snagging operations and the removal of jams or rafts; dredging towheads and shoals; constructing a substantial system of levees, either alone or by cooperating with riparian States, to fix the course of the river; the closure of all outlets that deplete the river; the fixing of caving banks to confine the river to the selected channel, and the prevention of injuries to regimen by new cut-offs or outlets. Work under this project extends from the Atchafalaya River, Louisiana, to Fulton, Ark., 508.6 miles, and snagging operations extend about 170 miles above Fulton to the mouth of Kiamichi River, Indian Territory. The nature of the improvement requires that it be continued for many years, and no estimate for completion is given on this account.

The amount expended from 1872 to the close of the fiscal year ending June 30, 1903, was \$1,612,030.88, with the following chief results: The channel cleared through the great raft in 1872-73 opened to navigation 188 miles of river above Shreveport to Fulton, and, at high stages, about 170 miles above Fulton. Subsequent work secured the complete removal of the raft, prevented formations of the same nature, increased the width of the river 100 feet or more, and there now flows in the course laid out for it in the old raft region a broad and deep river, safe for navigation at all but the lowest stages. Eleven years ago the channel bottom at head of the raft had lowered more than 15 feet, and this change continued downstream through the raft region, gradually diminishing to about 3 feet at Shreveport. The continual progressive scour has been attaining a normal slope in that stretch. Incidentally the removal of the raft drained the fertile valley, reclaiming thousands of acres of productive lands, and what was formerly a network of lakes, bayous, and pools has been brought under culti-

vation and now is traversed by several lines of railway. Tones Bayou Outlet is closed by a heavy earthen dam, connected with the line of levee above and below it. The main channel of the river below, formerly impaired by the outlet, has widened and scoured until it is capable of carrying the discharge at flood, and navigation of the stretch is uninterrupted at low stages. All of the chief outlets along the right bank of the river from Tones Bayou to the Louisiana-Arkansas line, 89 miles above, have been closed with dams, by cooperation with the State of Louisiana and local levee districts in connection with the construction of more than 150 miles of new levees and about 100 miles of enlargement. The proportion of the levee work built by the United States is less than 15 per cent. Work at Alexandria Falls rendered them navigable at all stages. The channel was deepened from 2½ feet to 5½ feet at the lower falls and to 6 feet at the upper falls, lengthening the period of navigation about two months. Persistent snagging operations, repeated from year to year, have kept the river open, prevented raft formations, reduced the dangers of navigation to a minimum, and enabled steamboats to make regular trips, the river from the Atchafalaya to Fulton ordinarily being open for boats of 3 feet draft at stages about a foot above zero of the Shreveport gauge. The maximum draft that can be carried at mean low water is 3 feet to Montgomery, La., 162.5 miles above the Atchafalaya; 2½ feet to Shreveport, La., 320.5 miles, and 2 feet to Fulton, Ark., 508.6 miles. The range between low and high water at the several gauge stations is as follows: Fulton, Ark., 35.65 feet; Shreveport, La., 41.2 feet; Alexandria, La., 41.95 feet; and Barbre Landing, La. (head of Atchafalaya River), 52.72 feet.

At present steamboats seldom run above Fulton, Ark. It is claimed, however, that at high stages the river is navigable in fact to the Missouri, Kansas and Texas Railway bridge near Denison; but if there were any boats navigation above Arthur, Tex., would be prevented by the fixed railway bridge at that place. Report on examination of this section of the river, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

When this improvement was resumed in 1872 the river was the chief means of transportation, but of late years a number of railways, both through and local lines, have been attracted to the fertile valley and their construction doubtless has aided materially in the advancement and building up of the country. Notwithstanding the additional facilities for transportation afforded by these lines, the commerce of Red River consists of large shipments of cotton, cotton seed and its products, lumber, staves, timber, etc., with heavy return freights of general merchandise of all kinds and plantation supplies. During the fiscal year 1903 this commerce aggregated 96,220 tons, valued at \$4,074,000. The commerce and navigation reported for the past fourteen years show great variations, probably due to changing crop conditions, occasional periods of extraordinary low water during the busy season, and other causes, ranging in quantity from 66,376 to 228,630 tons per annum, with estimated values of from \$3,194,000 to \$9,185,000. The average for the fourteen years is 106,377 tons, valued at \$5,132,360. To this should be added the commerce from Ouachita River, entering Red River at mouth of Black River, the average of

which is 176,906 tons, valued at \$6,339,300, making a total of 283,283 tons, valued at \$11,471,660.

Red River is still in a transitory state, and not yet an ideal stream by any means, but for the greater part of its length it now follows a fairly well-defined course, governed here and there by levees and at intervals by natural banks rising above the plane of high water. To maintain what has been accomplished and to gradually secure a more stable improvement will require a continuance of work under the existing project for many years. The estimated cost of the work needed is \$75,000 a year, or biennial appropriations of \$150,000, exclusive of the extraordinary demands for new plant that will arise from time to time.

For more extended information respecting the work performed, reference is invited to the report and illustrations on page 1909 of the Report of the Chief of Engineers for 1893, and to the subsequent reports of the district officers. Maps of Tones Bayou, Bayou Pierre, etc., are published in the Report of 1882, page 1542, and the Report of 1885, page 1490. An index sketch of the basin of Red River and diagrams showing the limits of high and low water are published in the Report of 1891, page 1956, and the Report of 1892, page 1587. Maps of the river at Shreveport are published in the Report of 1887, page 2682, and 1893, page 1921. Map of the river at Alexandria was printed in House Document No. 462, Fifty-sixth Congress, first session.

Reports on examinations, surveys, etc., will be found in the Reports of the Chief of Engineers and other documents enumerated below.

Locality, etc.	Report Chief of Engineers.		Documents.		
	Year.	Page.	No.	Congress.	Session.
Red River raft: Letter of Chief of Engineers relating to early work, etc.			Senate 29 ..	42d ..	Second.
Survey of Red River raft, Cypress Bayou, and Tones Bayou	1872	569	Senate 71 ..	42d ..	Second.
Reexamination of Red River raft	1873	635			
Examination of Red River above head of raft to Missouri, Kansas and Texas Railway bridge near Denison, Tex.	1879	954			
Reexamination of Red River above Fulton, Ark.	1879	986	Senate 42 ..	46th ..	Third.
Do	1885	1617			
Do	1900	1623	House 75 ..	48th ..	Second.
Do	1901	2565	House 53 ..	56th ..	First.
Examinations of Tones Bayou, Bayou Pierre, etc.	1879	2073	House 84 ..	56th ..	Second.
Do	1883	991	House 61 ..	45th ..	Third.
Do	1885	1139			
Survey of Bayou Pierre route	1885	1487			
Do	1886	1343			
Do	1887	1446			
Do	1888	1453			
Survey of falls near Alexandria, La.	1875	1338			
Do	1880	902			
Resurvey at Alexandria, La.	1887	1342	Senate 35 ..	46th ..	Second.
Do	1900	1444			
Survey at Shreveport, La.	1887	2569	House 462 ..	56th ..	First.
Resurvey at Shreveport, La.	1887	2673	House 195 ..	49th ..	Second.
Do	1893	1921			
Do	1903	1364			
Do		1369			
Red River below Shreveport, La. (report of general condition before improvement commenced)	1878	634			
Outlets of Red River above Shreveport, La., with estimates of cost of closure	1882	1546	Senate 154 ..	47th ..	First.
Examination of Sale and Murphy Outlet	1891	1952			
Examination of lakes in old raft region above Shreveport, La., with view to reopening navigation with Red River.	1887	1490			

Locality, etc.	Report Chief of Engineers.		Documents.		
	Year.	Page.	No.	Congress.	Session.
Survey of Red River from Fulton, Ark., to the Atchafalaya River, La	1887	1446			
	1888	1337			
	1889	1591			
	1890	1830			
	1891	1864			
	1892	1594			
	1893	1921			
	1894	1430			
	1895	1439			
	1896	1583			
Latest compilation of levels, bench marks, etc., of Vicksburg district, including those of Red River survey	1900	2489			
	1902	1446	House 448..	57th ..	First.

July 1, 1902, balance unexpended.....\$145, 219. 94
 June 30, 1903, amount expended during fiscal year..... 25, 250. 82

July 1, 1903, balance unexpended..... 119, 969. 12
 July 1, 1903, outstanding liabilities..... 973. 53

July 1, 1903, balance available..... 118, 995. 59

July 1, 1903, amount covered by uncompleted contracts..... 19, 931. 92

{ Amount that can be profitably expended in fiscal year ending June 30,
 1905, in addition to the balance available July 1, 1903 135, 000. 00
 Submitted in compliance with requirements of sundry civil act of June
 4, 1897.

(See Appendix X 1.)

2. *Cypress Bayou, Texas and Louisiana.*—During the period of the great raft in Red River the bottom lands of Cypress Bayou were flooded, became lakes, and afforded a navigable route from Red River, near Shreveport, La., to Jefferson, Tex. Work by the United States for improvement of this route commenced in 1872, and from 1872 to 1879 \$94,000 was appropriated for the purpose. The funds were expended for dredging and straightening the channel, removing stumps, snags, and logs, and cutting leaning timber. This work was completed in 1880, but on account of its temporary nature appropriations and allotments aggregating \$39,701.33 were made for its maintenance.

The removal of the raft and the subsequent closure of outlets and construction of levees down the right bank of Red River from the hills in Arkansas to near Shreveport, La., cut off the water supply of the lakes and caused them to gradually dry up. In consequence the period of navigation was shortened from year to year until 1897, when boats ceased plying from Red River altogether. A survey to ascertain if improvement could be obtained by locks and dams was completed in 1893, but the plan proposed was not adopted by Congress, presumably because of its great cost and the uncertainty of results in the way of reviving navigation.

The amount expended to June 30, 1903, was \$130,135.17 for improvement and maintenance and \$12,000 for surveys.

Navigation can be restored only by a system of locks and dams, upon which large sums might be spent for construction and maintenance without any return of commerce. The expenditure of the

available balance for dredging or for the removal of stumps, etc., will afford no relief. For these reasons the work is not considered worthy of further improvement.

Reference is invited to the special report published as House Executive Document No. 252, Fifty-first Congress, first session, which gives extended information of this improvement; (see Report of the Chief of Engineers, 1890, p. 1914); also to reports on examinations and surveys published in the Reports of the Chief of Engineers, as follows: Preliminary examination and survey, 1872, page 568, and 1873, page 635; reexamination, 1885, page 1552 (H. Ex. Doc. No. 103, 48th Cong., 2d sess.); and survey, 1893, page 2065.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$4,802.26
June 30, 1903, amount expended during fiscal year	1,238.10

July 1, 1903, balance unexpended	3,566.16
--	----------

(See Appendix X 2.)

3. *Ouachita and Black rivers, Arkansas and Louisiana.*—The improvement of Ouachita River by the United States was commenced in 1871. At that time navigation was much obstructed at all stages by snags, sunken logs, wrecks, leaning and caving trees, etc., and at low stages the greater part of the river was unnavigable on account of numerous rock, gravel, and sand bars.

A project was entered upon in 1871 for a temporary improvement from Trinity, La., to Arkadelphia, Ark., by the removal of snags and other obstructions and by dredging the worst bars. In 1872 a project was adopted for locks and dams to give 4 feet depth from Trinity, La., to Camden, Ark., but it was abandoned two years later. The project under which work continued after 1874 contemplated the removal of snags, logs, wrecks, leaning timber, etc., obstructing navigation below Camden, Ark. The stretch of 56 miles known as Black River, below Trinity to Red River, Louisiana, was added to the project in 1884. The amount expended on the original and modified projects prior to operations under existing project was \$605,802.19.

The existing project, approved July 14, 1902, was entered upon by a provision in the river and harbor act of 1902, and contemplates the construction of nine locks and movable dams, to provide a navigable depth of 6½ feet from the mouth of Black River, Louisiana, up to a point 10 miles above Camden, Ark. (360 miles), at an estimated cost of \$1,998,576; completion of maps of survey, etc., and the continuance of snagging, for maintenance of past work, at an annual cost of about \$20,000. The amount expended under this project to June 30, 1903, was \$31,435.81, of which \$6,763.75 was used for completion of survey and \$14,301.72 for maintenance. The available funds are to be applied chiefly to the construction of two locks and dams—No. 4, at Monroe, La., and No. 6, at Roland Raft, Ark., the building of which has not commenced.

The work heretofore done consisted chiefly of the removal of snags, logs, wrecks, leaning timber, tree slides, etc., for the purpose of maintaining navigation, and the improvement of a rock and gravel bar, known as Catahoula shoals, about 20 miles above Trinity, La. Opera-

tions were not directed so much toward an increase of depth as to an increase of safety of navigation, though the work at Catahoula shoals increased the available depth from 15 to 40 inches. At moderately high stages, or during six to seven months of the year, New Orleans steamboats ascend the river to Camden, Ark.; at medium stages they run to Monroe, La., but during the periods of low water Harrisonburg, La., 72 miles above Red River, is considered the head of navigation, though small local packets make trips between points on the river above. The maximum draft that can be carried at mean low water is $3\frac{1}{2}$ feet to Harrisonburg, La., $1\frac{1}{2}$ feet to Monroe, La., and 8 inches to Camden, Ark. The range between high and low water at the several gauge stations on Ouachita River is as follows: Camden, Ark., 44.2 feet; Monroe, La., 48.6 feet; Riverton, La., 51.3 feet, and Jonesville, La., 54.1 feet. Camden, Ark., is considered the head of navigation, but at high stages the river is navigable, in fact, to Arkadelphia, Ark.

The commerce of Ouachita River and its tributaries is considerable, and consists of shipments of cotton, cotton seed, lumber, staves, saw logs, and miscellaneous articles, with return freights of general merchandise and plantation supplies. Most of the cotton is shipped to New Orleans, and large quantities of staves for export are sent to that city each year. The commerce reported for the fiscal year 1903 aggregated 236,179 tons, valued at \$5,619,000. The volume of commerce as reported for the past fourteen years ranges between 73,679 and 313,863 tons per annum, with values estimated at \$3,293,000 to \$10,234,250. The average for the fourteen years is 176,906 tons, valued at \$6,339,300. The variations are due to crop yields, the uncertainty of navigation, droughts, and other causes, and the proposed improvement by locks and dams is for an extension of benefits by affording navigation to Camden the year round.

For more extended information respecting this improvement, reference is invited to the Report of 1895 (p. 1887) and to subsequent reports of the district officers.

Reports on examinations and surveys will be found in the following Reports of the Chief of Engineers, viz: Preliminary examination from Rockport, Ark., to Louisiana State line (H. Ex. Doc. No. 60, Pt. 4, 41st Cong., 3d sess.), 1871, page 334. Survey from Camden, Ark., to Trinity, La., 1872, page 367. Resurvey from Camden, Ark., to Trinity, La. (H. Ex. Doc. No. 259, 43d Cong., 1st sess.), 1874, page 352. Examinations from Camden to Arkadelphia, 1884, page 1351; 1887, page 1487, and 1893, page 2091. Examination and survey of harbors of Monroe and Trenton, La., and examination of river from Camden to mouth, with plan and estimate for continuing improvement (S. Ex. Doc. No. 69, 48th Cong., 1st sess.), 1884, pages 1381, 1383, and 1386. Examination of Black River from Trinity to Red River, Louisiana, 1884, page 1363. Examination of Catahoula shoals, 1880, page 1307. Survey of Catahoula shoals, with maps, 1891, page 1967. Examination of river from mouth to head of navigation, 1889, page 1631. Examination of river front at Camden, Ark. (H. Doc. No. 96, 56th Cong., 2d sess.), 1901, page 2090. Last survey of river, upon which present plan of improvement is based; preliminary report, with maps (H. Doc. No. 480, 56th Cong., 1st sess.), 1900, page 2544; final report, with estimates (H. Doc. No. 448, 57th Cong., 1st sess.), 1902, page 1435.

July 1, 1902, balance unexpended	\$118, 197. 81
Amount appropriated by sundry civil act approved March 3, 1903	250, 000. 00
Amount received from sales of property	568. 71

June 30, 1903, amount expended during fiscal year	368, 766. 52
	32, 004. 52

July 1, 1903, balance unexpended	336, 762. 00
July 1, 1903, outstanding liabilities	72. 67

July 1, 1903, balance available	336, 689. 33
---------------------------------------	--------------

(Amount (estimated) required for completion of existing project	1, 668, 576. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	" 403, 954. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix X 3.)

4. *Bayou Bartholomew, Boeuf River, Tensas River, and Bayou Maçon, and bayous D'Arbonne and Corney, Louisiana and Arkansas.*—These streams are tributaries of Ouachita River, and were navigated at high stages to a considerable extent before their improvement was undertaken by the United States, but the passage of steamboats was difficult and dangerous on account of numerous obstructions, consisting of snags, sunken logs, wrecks, leaning timber, etc.

In the river and harbor act of March 3, 1881, Congress entered upon projects for the removal of these obstructions, so as to give greater ease and safety to the navigation of Bayou Bartholomew, Boeuf River, and Tensas River. The river and harbor act of July 5, 1884, appropriated funds for the same kind of work in bayous D'Arbonne and Corney, and added Bayou Maçon to the improvement of Tensas River; and under the river and harbor act of August 5, 1886, a supplemental project was entered upon for the closure of three outlets of Boeuf River. The various works continued for twenty-one years under four distinct titles of appropriation, but were consolidated by the river and harbor act of June 13, 1902, in a general appropriation for maintenance of the work performed. Drift, sliding and caving banks, and the rapid growth of vegetation constantly add obstructions to navigation, which become more difficult to remove each year they are allowed to remain.

The projects are epitomized as follows:

Stream.	Original project.		Modifications of project.	
	Nature of work.	Year adopted.	Nature.	Year adopted.
Bayou Bartholomew, Louisiana and Arkansas.	Removing obstructions between mouth and Baxter, Ark., 182 miles; completed, 1897, to McComb Landing, Ark., 141 miles.	1881	Maintenance of work below McComb Landing, the head of navigation; annual cost, \$2,500.	1897
Boeuf River, Louisiana.	Removing obstructions between mouth and Wallace Landing, about 170 miles; completed, 1896.	1881	Closing three outlets near Point Jefferson (closed, 1887-88, at cost of \$5,441.78, but dams destroyed in 1890 and not rebuilt). Maintenance of work below Wallace Landing, the head of navigation, annual cost, \$2,500.	1886 1897

^a Of this amount \$103,954 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

Stream.	Original project.		Modifications of project.	
	Nature of work.	Year adopted.	Nature.	Year adopted.
Tensas River and Bayou Maçon, Louisiana.	Removing obstructions between mouth of Tensas River and Dallas, 138 miles above; completed, 1898, to Westwood, head of navigation, 81 miles.	1881	Removing obstructions between mouth of Bayou Maçon and Floyd, 112 miles; completed, 1899. Lane Ferry, about 20 miles above Floyd, is head of navigation in Bayou Maçon.	1884
Bayous D'Arbonne and Corney, Louisiana.	Removing obstructions between mouth of Bayou D'Arbonne and Stein Bluff, on Corney branch, 40½ miles above; completed, 1896.	1884	Maintenance of work performed in both streams; annual cost, \$2,500.	1900
			Extending work in Bayou Corney above Stein Bluff, 16½ miles to Cobb Landing; completed, 1896.	1892
			Removing obstructions in Little D'Arbonne branch (\$1,000).	1894
			Maintenance of work performed between mouth of Bayou D'Arbonne and Cobb Landing, the head of navigation; annual cost, \$1,000.	1902

The expenditures to June 30, 1903, and the unexpended balances that date were as follows:

Stream.	For improvement.	For maintenance.	Total.
Bayou Bartholomew	\$45,873.53	\$8,805.82	\$54,679.35
Bœuf River	46,434.62	8,567.90	54,992.52
Tensas River and Bayou Maçon	11,947.02	3,938.89	39,801.33
Bayous D'Arbonne and Corney	23,915.42	1,936.42	19,936.42
	18,000.00		
Total expenditure	146,170.59	23,239.03	169,409.62
Balance unexpended		16,590.38	16,590.38
Total amount appropriated			186,000.00

The streams are not navigable for steamboats at low-water. The work performed has reduced the dangers of navigation; enabled larger boats to run, and to make trips in less time than was required formerly; has lengthened the periods of navigation, and has resulted in lower rates of freight.

The commerce of these streams consists chiefly of shipments of cotton, cotton seed, staves, timber, etc., and return freights of general merchandise and plantation supplies. It varies with the crops, and to a considerable extent with the navigable stages, which frequently are not coincident with the needs of transportation. The volume and changes of the commerce are shown in the following table:

Stream.	Maximum reported.			Minimum reported.			Average.		
	Year.	Tons.	Value.	Year.	Tons.	Value.	Period years.	Tons.	Value.
Bayou Bartholomew	1891	49,299	\$826,000	1903	2,080	\$171,000	14	14,581	\$346,260
Bœuf River	1897	11,261	69,000	1903	545	30,000	14	6,476	279,880
Tensas River and Bayou Maçon	1899	23,605	774,000	1893	2,649	122,500	14	14,194	549,700
Bayous D'Arbonne and Corney	1890	14,416	646,000	1903	682	55,000	8	7,226	424,600
Total		98,581	2,315,000		5,956	378,500		42,487	1,600,440

A condensed history of the work performed to that time in Bayou Bartholomew, Bœuf River, and Tensas River and Bayou Maçon will be found in the Report of the Chief of Engineers for 1896, pages 1601 to 1613. The last published report of improvement of bayous D'Arbonne and Corney is in the Report of 1895, page 1914. Subsequent reports of the district officers refer only to the yearly operations.

Reports of examinations and surveys will be found in the following Reports of the Chief of Engineers:

Bayou Bartholomew.—From mouth to Arkansas State line, 1872, page 383. From mouth to Baxter, Ark. (H. Ex. Doc. No. 61, 45th Cong., 3d sess.), 1879, page 997, and (H. Ex. Doc. No. 38, 46th Cong., 3d sess.) 1881, page 1453. Above Baxter, Ark., to Lincoln County line (H. Ex. Doc. No. 147, 48th Cong., 2d sess.), 1885, page 1548.

Bœuf River.—From mouth to Arkansas State line (H. Ex. Doc. No. 38, 46th Cong., 3d sess.), 1881, page 1424. Three outlets near Point Jefferson, Louisiana (H. Ex. Doc. No. 99, 48th Cong., 2d sess.), 1885, page 1545; 1891, page 1986; 1893, page 2016, and 1896, page 1608. Above Wallace Landing, Louisiana (H. Ex. Doc. No. 350, 53d Cong., 3d sess.), 1895, page 1969.

Tensas River.—From mouth to headwaters near Lake Providence, La. (H. Ex. Doc. No. 38, 46th Cong., 3d sess.) 1881, page 1457.

Bayou Maçon.—From mouth to headwaters in Desha County, Ark. (House Ex. Doc. No. 38, 46th Cong., 3d sess.), 1881, page 1462. Above Floyd, La. (House Ex. Doc. No. 349, 53d Cong., 3d sess.), 1895, page 1974.

Bayous D'Arbonne and Corney.—Examination and survey from the mouth of D'Arbonne to Stein Bluff, on the Corney (Senate Ex. Doc. No. 69, 48th Cong., 1st sess.), 1884, pages 1372 and 1376.

July 1, 1902, balance unexpended	\$22, 741.06
June 30, 1903, amount expended during fiscal year.....	6, 150.68

July 1, 1903, balance unexpended	16, 590.38
July 1, 1903, outstanding liabilities	413.61

July 1, 1903, balance available	16, 176.77
---------------------------------------	------------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	17, 000.00

(See Appendix X 4.)

5. *Mouth of Yazoo River, and harbor at Vicksburg, Miss.*—The shifting bar at mouth of the Yazoo has been the most serious obstruction to the navigation of that river and its various tributaries, a system comprising about 800 miles of navigable waterways. At low stages steamboats have been prevented from entering or leaving the river without lightering their cargoes across the bar, and it frequently happened that the outlet was entirely closed to navigation during the busiest season of the year.

Prior to 1876 the city of Vicksburg, built on the range of bluffs forming the southern limit of the Yazoo Basin, possessed the most commanding site and the finest harbor on the Mississippi River. There was deep water along the city front, and the entire width of river was available for steamboats at all stages, with not less than 25

feet depth in any part of the harbor. The cut-off of April 27, 1876, and the subsequent shoaling of the channel leading from the river to the resulting lake front of the city, practically destroyed the harbor, which became unnavigable except at high stages of the river.

The original project for improving Vicksburg Harbor was based upon the report of a Board of Engineers dated January 22, 1878, and was entered upon in the river and harbor act of June 18, 1878. The first operations consisted of revetting the rapidly caving bank at Delta Point, Louisiana, opposite Vicksburg, the continued recession of which was increasing the distance from the harbor proper to the river channel. From 1878 to 1881 there were built about 5,400 linear feet of revetment, 1 mattress spur dike, and 2 screen dikes, at a cost of \$203,229.87. The river and harbor act of August 2, 1882, placed the work under the Mississippi River Commission; the revetment at Delta Point was continued, 6,448 linear feet was built, and repairs to the upper bank paving were made. Practically all of the work performed prior to 1882 was destroyed or covered up by the later work. Only the mats built in 1893-94 (1,065 feet) have the present standard width of 300 feet, the earlier ones being from 150 to 175 feet wide. Extensive repairs were made in 1899-1900. No work has been done at Delta Point since. Some caving has occurred above the upper end of the revetment, which, however, is protected by a hard point, and there appears to be no immediate danger of flanking. The amount expended by the Mississippi River Commission at Delta Point was \$186,256.21, which, with the prior expenditures of 1878-1881, makes a total of \$389,486.08.

When Vicksburg Harbor was placed under supervision of the Mississippi River Commission in 1882 a project was adopted for dredging a basin 1,700 feet long by 300 feet wide in the harbor, and a canal 150 feet wide to connect it with the river. Dredging under this project amounted to 350,035 cubic yards in 1883 when discontinued. It was renewed in 1888, under a slightly modified project, and continued until 1893. During the latter period the dredging amounted to 1,729,994 cubic yards, making a total of 2,080,029 cubic yards of excavation. In 1888 pile dikes were built at the north end of the basin and along the west side of the canal, aggregating 6,800 feet in length. The total expenditures in Vicksburg Harbor were \$442,724.77, which, added to the amounts expended at Delta Point, makes a total of \$832,210.85. The improvement of Vicksburg Harbor proper was transferred from the Commission to the Engineer Department under a provision of the river and harbor act of August 18, 1894.

The existing project, adopted by Congress in the river and harbor act of July 13, 1892, contemplated opening a new mouth or outlet for Yazoo River from its original mouth on Old River (9.8 miles above the outlet to the Mississippi) through deep water down the wrong end of Old River, thence across a neck of low land between Old River and Lake Centennial, and around the head of De Soto Island and down the east arm of Lake Centennial to the Mississippi River, entering it upon the channel side at Kleinston Landing. Lake Centennial is the old bend of the Mississippi River, cut off in 1876, and De Soto Island, prior to the cut-off, was the Louisiana peninsula, around which the river flowed. The estimate of cost—\$1,500,000—was revised in 1893 and reduced to \$1,200,000, upon a basis of completion in three years. The latter sum was appropriated between 1892 and 1901.

In a special report, dated June 28, 1902, Captain Potter, the local engineer, discussed a plan for preventing the circulation of eddy currents and consequent deposits in Vicksburg Harbor, and proposed the construction of a levee from a point on the accretion below the foot of De Soto Island, near mouth of the harbor, westward up the bank of the Mississippi, and across the West Pass of Lake Centennial to high ground at or near King Point. The plan was considered and recommended for approval by a Board of Engineers July 25, 1902, with suggestions that the canal end of the levee be turned northward toward the foot of De Soto Island, and that the levee terminate some distance below King Point, and be extended, if found necessary. The recommendations of the Board were approved August 2, 1902.

The amount expended under the existing project at close of the fiscal year ending June 30, 1903, was \$958,451.71, with the following results: The excavation for the diversion route was practically complete, 6,155,012 cubic yards of earth having been removed. The route was opened to navigation in February, 1903, and dredging operations since then have been for the purpose of finishing incomplete stretches and removing fill in the harbor. The West Pass of Lake Centennial is closed by a dam which has withstood the phenomenal flood of 1903, and which will be strengthened by the proposed line of levee. A dam, above low water, has been built across the west arm of Lake Centennial, from mouth of the main cut to head of De Soto Island. The new outlet was designed to afford a maximum draft of 6 feet at mean low water. The extreme range between low and high water at Vicksburg is 59 feet. The usual variation of water surface is 45.3 feet.

The annual commerce of Yazoo River, its tributaries, and Vicksburg Harbor, as reported for seven years, varies between 222,792 and 441,765 tons, the estimated values of which range from \$6,801,000 to \$13,272,000 per annum. The average of the commerce is 321,594 tons per annum, and the average of the value is \$8,753,650.

The proposed levee from mouth of the canal westward toward King Point will be built during the period of low water this summer and autumn to prevent the circulation and consequent deposit in the harbor next flood season. The estimated cost of this work is \$125,000. Until Yazoo River adjusts itself to the new outlet it is impracticable to say what contingencies may arise or whether additional work may be necessary to maintain the improvement. The balance unexpended July 1, 1903, probably will suffice for a year. At present it is impracticable to say whether additional funds for maintenance may be required during the fiscal year ending June 30, 1905.

Details of the work performed at Delta Point are given in the Annual Reports of the Chief of Engineers for 1879, page 974; 1880, page 1333; 1881, page 1384; 1882, page 1502; 1883, page 2290; 1884, page 2820; 1885, pages 2787 and 2964; 1889, page 2709; 1893, page 3754; 1894, page 2921; 1898, page 3373; 1900, page 4827, and 1902 (Supplement), page 110. Maps accompany the Reports for 1883, 1884, 1888, 1889, 1893, and 1900.

Details of the work performed by the Mississippi River Commission in Vicksburg Harbor are given in the Annual Reports of the Chief of Engineers for 1884, page 2821; 1888, page 2282; 1889, page 2710; 1890, page 3234; 1891, page 3628; 1892, page 3180; 1893, page 3754; 1894,

page 2921, and 1897, page 3728. Maps of the harbor accompany the Reports for 1878 (p. 644), 1883, 1884, 1888, 1889, 1890, and 1893.

Details of the work performed under the existing project for diverting the mouth of Yazoo River, etc., will be found in the Annual Reports of the Chief of Engineers for 1893, page 2029; 1894, page 1488; 1895, page 1933; 1896, page 1618; 1897, page 1927; 1898, page 1625; 1899, page 2015; 1900, page 2524; 1901, page 2052; 1902, page 1420; and in Appendix X 5, herewith. Maps accompany the Reports of 1893, 1894, 1901, and 1902. Fifteen photographs were printed in the Report of 1900.

Reference is invited to reports on examinations and surveys, viz: Examination and survey of Mississippi River near Vicksburg, with a view to preventing the threatened cut-off, House Executive Document No. 4, Forty-second Congress, first session. Report of a Board of Engineers upon subject of preservation of the water front of Vicksburg, with maps and estimates, Senate Executive Document No. 55, Forty-fifth Congress, second session (reprinted in Report, Chief of Engineers, 1878, p. 638). Survey of lower Yazoo River with a view to improving its mouth so as to permit passage through same at all seasons of the year, House Executive Document No. 125, Fifty-second Congress, first session (reprinted in Report, Chief of Engineers, 1892, p. 1627). Revision of estimates, Report, Chief of Engineers, 1893, page 2032.

July 1, 1902, balance unexpended	\$401, 507. 28
June 30, 1903, amount expended during fiscal year	159, 958. 99
July 1, 1903, balance unexpended	241, 548. 29
July 1, 1903, outstanding liabilities	5, 245. 28
July 1, 1903, balance available	236, 303. 01
July 1, 1903, amount covered by uncompleted contracts	6, 820. 00

(See Appendix X 5.)

6. *Yazoo, Tallahatchie, and Big Sunflower rivers, and Tchula Lake, Mississippi.*—The improvement of Yazoo River by the United States was commenced in 1873. At that time the period of navigation was limited to the high stages on which steamboats could pass the wrecks of gunboats and steamers and raft sunk for the purpose of preventing passage during the war of the secession. The channel was also much obstructed by numerous snags, stumps, tree slides, sunken logs, etc., and by a heavy growth of leaning timber along the banks. The improvement of Tallahatchie and Big Sunflower rivers, the principal tributaries of the Yazoo, was commenced in 1879. At that time Tallahatchie River was navigable to Sharkey, about 65 miles above its mouth, during six months of the year, but passage was difficult and dangerous at all stages, on account of the great number of obstructions in the channel and along the banks, including the wreck of the ocean steamship *Star of the West*, sunk in February, 1863, about 8 miles above the mouth. Above Sharkey the growth of leaning timber was dense, the boughs from opposite banks at places overlapped the river, and this condition, together with the number of snags, logs, and stumps in the channel, rendered that part of the stream practically impassable. An examination of Big Sunflower River in 1878 showed that it was navigable for very light boats about six months of the year, but that

navigation was much obstructed by snags, sunken logs, sand bars, and shoals; that it was impeded at all stages by the leaning timber, and that at many places the channel was so choked with obstructions as to afford no greater depth than 18 inches and was so narrow that it gave passage room for the smallest craft only. The improvement of Tchula Lake, an arm of the Yazoo River in Holmes County, about 60 miles long and flowing down the east side of Honey Island, was commenced in 1881. Before the improvement was undertaken navigation through the lake was obstructed its entire length by a network of logs on the bottom, with arms projecting upward, and by sawyers, heavy leaning timber, and a thick growth of brush along both banks, which at places encroached on the channel until passage of steamboats was difficult at any stage.

The original project of 1873 contemplated removing obstructions to give ease and safety to the navigation of Yazoo River. The additional projects of 1879 contemplated the same kind of work in Tallahatchie River from its mouth to the entrance of Coldwater River, about 100 miles above, and in Big Sunflower River from its mouth to Clarksdale, Miss., about 180 miles above, and the building of inexpensive pile and brush wing dams to scour depths of about 40 inches on the bars. The river and harbor acts of 1880, 1881, and 1882 required expenditures aggregating \$10,000 for the improvement of Tallahatchie River above mouth of the Coldwater River to Batesville, Miss. Under the river and harbor act of 1881 the removal of the obstructions in Tchula Lake was commenced, for the purpose of prolonging the navigable period and to permit light-draft steamboats to pass through the lake earlier in the cotton season.

Until 1902 the four works were carried on under separate distinct appropriations, but the river and harbor act approved June 13, 1902, combined them in a general appropriation for continuing the improvements and for maintenance of the work done in Yazoo, Tallahatchie, and Big Sunflower rivers, with a provision that not exceeding \$4,000 should be used for the removal of obstructions at the lower end of Tchula Lake. Under project approved August 2, 1902, work for the improvement and for maintenance of navigation has continued under the plans formerly pursued, with allotments from the general appropriation approved by the Secretary of War July 30, 1902.

The amounts expended to the close of the fiscal year ending June 30, 1903, and the unexpended balances upon that date were as follows:

	Amount expended.	Balances unexpended.
For improvement of—		
Yazoo River.....	\$294,164.99	\$21,835.01
Tallahatchie River.....	61,418.32	4,081.68
Big Sunflower River.....	83,321.18	13,678.82
Tchula Lake.....	23,815.56	1,184.44
Total.....	462,720.05	40,779.95

The results from the work performed are marked: In Yazoo River the large number of wrecks that blocked the channel and restricted the period of navigation to high stages was removed so as to present no obstruction, and work for the removal of snags, logs, leaning timber, etc., repeated from time to time, had opened and maintained

steamboat navigation from the mouth to the head of the river. Various short stretches of Yazoo River are more or less obstructed by bars at the lowest stages, but steamboats of 3½ feet draft navigate the river at mean low water without serious difficulty. The range between low and high water at Yazoo City is 40.8 feet. In Tallahatchie River the wreck of the steamship *Star of the West* was destroyed, and obstructions were removed from the channel and banks so as to permit steamboats of 3 feet draft to run to Sharkey the year round and into Coldwater River at moderately high stages. In Big Sunflower River the leaning timber has been removed, the banks are remarkably stable, and work from time to time for the removal of channel obstructions and for the building and renewal of wing dams at the bars has maintained navigation in the lower 100 miles and enabled boats of 30 inches draft to run to Woodburn, 77 miles above the mouth, at mean low water. The work in Tchula Lake was completed in 1895, but was of temporary character, and during the past year the obstructions at its lower end, consisting of accumulations of drift in jams, snags, logs, leaning trees, brush, etc., were removed.

Yazoo River is navigable its entire length the year round. Tallahatchie River is navigable to Sharkey the year round, and thence to and up the Coldwater River about 80 miles to Yazoo Pass at high stages. The mouth of Coldwater River is considered the head of navigation of the Tallahatchie, but it is navigable in fact for 10 or 15 miles above that point. Clarksdale now is the head of navigation of Big Sunflower River only at long intervals during periods of general overflow from Mississippi River caused by disasters to the levees. Faison, about 100 miles above the mouth, is considered the head of navigation. Boats can pass through Tchula Lake at moderately high stages.

The chief shipments out of Yazoo River and tributaries are cotton, cotton seed, staves, timber, etc., with return freights of general merchandise and plantation supplies. The commerce for the past thirteen years ranges between 102,098 and 544,503 tons annually, with values estimated at \$2,840,000 to \$9,198,000, the average being 222,926 tons, valued at \$5,401,750. The tonnage of the past year was more than double that reported for any of the twelve years preceding.

Floods, sliding and caving banks, and the rapid growth of vegetation along these alluvial rivers constantly add obstructions and render a continuance of snagging operations necessary in the interest of safe and uninterrupted navigation. For this purpose the sum of \$20,500 could be expended profitably each year for maintenance, as follows:

Yazoo River	\$15,000
Tallahatchie River	2,500
Big Sunflower River	3,000
Total	20,500

In cases of biennial appropriations twice this sum is needed, as obstructions become more difficult to remove each year they are permitted to remain in the channel. These estimates are for operating expenses only, and do not cover extraordinary needs from time to time for renewal of plant, etc. At present a powerful steel-hull snag boat is much needed for continuing work in this system of rivers, to replace the *John R. Meigs*, destroyed by accident in 1898, the cost of which is estimated at \$60,000.

A résumé of the work performed in Yazoo, Tallahatchie, and Big Sunflower rivers is given in the Report of 1896, pages 1613, 1626, and 1630. Subsequent annual reports of the district officers give each year's operations only.

Reports of examinations and surveys will be found in the following Reports of the Chief of Engineers, viz: Examinations of Yazoo River, 1873, page 483, and 1874, page 365. Survey of Yazoo River from Yazoo and Mississippi Valley Railroad bridge to mouth (H. Ex. Doc. No. 125, 52d Cong., 2d sess.), 1892, page 1626. Survey of bar at Yazoo City, 1896, page 1615. Examinations of Tallahatchie and Big Sunflower rivers (S. Ex. Doc. No. 42, 45th Cong., 3d sess.), 1879, page 982. Reexamination of Tallahatchie River, 1880, page 1322. Report of examination of Tallahatchie River above mouth of Coldwater River to Batesville will be submitted to Congress in December, 1903. Reexamination of Big Sunflower River (S. Doc. No. 245, 54th Cong., 1st sess.), 1896, page 1638, and 1899, page 362. Examination of Tchula Lake (S. Ex. Doc. No. 35, 46th Cong., 2d sess.), 1880, page 1350.

July 1, 1902, balance unexpended	\$64,014.38
June 30, 1903, amount expended during fiscal year	23,234.43
July 1, 1903, balance unexpended	40,779.95
July 1, 1903, outstanding liabilities	29.25
July 1, 1903, balance available	40,750.70

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix X 6.)

IMPROVEMENT OF ARKANSAS RIVER AND OF CERTAIN RIVERS IN ARKANSAS AND MISSOURI.

This district was in the charge of Capt. Graham D. Fitch, Corps of Engineers. Division Engineer, Col. Amos Stickney, Corps of Engineers, to February 13, 1903, and Lieut. Col. H. M. Adams, Corps of Engineers, since that date.

1. Arkansas River, Arkansas.—In its original condition the channel of the river was greatly obstructed by shifting sand bars and numerous snags in its lower reaches, and by gravel and rock shoals and some snags in its upper reaches. Navigation was difficult and uncertain at medium and low stages, and during periods of extreme low water was impossible.

Prior to act of Congress approved June 13, 1902, the work on this river was carried on under two general projects—one entitled "Removing obstructions in Arkansas River, Arkansas and Kansas," the other "Improving Arkansas River, Arkansas."

The original project for "Removing obstructions in Arkansas River, Arkansas and Kansas" (act July, 1832), was to remove snags and wrecks. Subsequently this project was enlarged to include removing bars by wing dams, and many of the appropriations were made for this work in combination with other rivers. By act of March 3, 1879, Congress adopted an additional project—that of improving the river between Fort Smith, Ark., and Wichita, Kans., by removing the snags

and rocks and constructing dams at some of the worst shoals. Later these projects were merged into one, making the project extend from the mouth of the river to Wichita. Under these projects there was expended to June 30, 1902, \$968,256.81.

The original projects for "Improving Arkansas River, Arkansas," were local and had in view the permanent improvement of the river at Fort Smith, Vanburen, Dardanelle, and Pine Bluff. By act of August 11, 1888, Congress adopted a general project, namely: "That the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the Report of the Chief of Engineers for the year ending July 1, 1885, and as authorized in the act for the improvement of rivers and harbors approved August 5, 1886, and in House Executive Document No. 90, Forty-ninth Congress, first session, said methods to be applied as the Secretary of War may direct at such points between Wichita, Kans., and the navigable mouth of the Arkansas River at its junction with the Mississippi River, as he may deem for the best interest of commerce." The "said methods" referred to in the act were "To remove rock and gravel reefs by blasting and dredging, to contract the channel by dikes and dams, permeable or solid, of such construction as the local conditions require, and to hold the channel so obtained by revetment where necessary." The improvement authorized by the act covers 771 miles, while estimates had been rendered for 708 miles, thus making the estimated cost of the improvement under this project indefinite. Act of August 18, 1894, authorized the operation of snag boats under this head in addition to similar operations under the project "Removing obstructions in Arkansas River, Arkansas and Kansas." To the close of the fiscal year ending June 30, 1902, there had been expended under the general project for improving Arkansas River, Arkansas, \$903,311.93 for original construction, \$314,119.14 for maintenance, and \$63,397.32 for operating snag boats, making the total amount \$1,280,828.39.

Act of Congress approved June 13, 1902, merged these two general projects into one, which makes the existing project in substance: "The improvement of the river from its mouth to the head of navigation by snagging operations, by dredging operations, and by contraction works, holding the improved channel by revetment where necessary." No definite estimate of cost can be given.

To June 30, 1903, there had been expended under the consolidated project \$33,174.11, \$25,000 of which was for operating snag boats and \$8,174.11 for maintenance of works for permanent improvement. The total expenditures under all projects to June 30, 1903, is \$2,282,259.31, of which \$1,056,654.13 is for operating snag boats, \$903,311.93 for original construction of works for permanent improvement, and \$322,293.25 for maintenance of those works.

Aside from the protection to the town front of Pine Bluff and the preservation of channel through the drawspans of the railway bridges at Fort Smith, Vanburen, and Little Rock, the operations for the permanent improvement of the stream have been of no material benefit to navigation. Snagging operations give immediate relief, but the benefit is temporary.

During the low-water period of this fiscal year navigation was suspended out of Fort Smith from October 17 to November 11; out of Little Rock from August 23 to 30, from September 22 to 27, and from

October 23 to November 16; and out of Pine Bluff from November 1 to 14. During the lowest stage the Memphis-Pine Bluff packet could not ascend the river higher than Upper ReydeU, 57 miles above the mouth. From that point on through to Webbers Falls, a distance of 373 miles, the channel depths at that time were about 18 inches. Fort Gibson, on the Grand River, 2 miles above its mouth and 463 miles from the mouth of the Arkansas River, is the head of navigation, but no report was received of any navigation above Webbers Falls, 430 miles above the mouth, this fiscal year.

Commercial statistics year ending May 31.

Year.	Tons.	Value.	Year.	Tons.	Value.
1894.....	63,563	\$2,846,395	1899.....	68,057	\$2,470,131
1895.....	50,498	2,380,420	1900.....	75,654	2,078,940
1896.....	54,261	2,408,720	1901.....	71,998	2,628,797
1897.....	66,077	1,657,218	1902.....	40,567	1,630,297
1898.....	58,578	1,626,756	1903.....	86,068	2,389,020

The expenditures this fiscal year were for operating two snag boats and making partial repair to revetment at Red Fork, where a caving bank endangered a levee. Excepting the \$49,530 reserved for application on a hydraulic dredge, the balance available will be expended in snagging operations and in completing repair to Red Fork revetment to the extent contemplated when contract for the work was entered into December 8, 1902.

Because of the very small volume of flow and the great number of shoals existing in the Arkansas River, together with the instability of the channel, the district officer is of the opinion that some experimental dredging should be done in the stream before any large amount of money is expended in procuring plant for this particular work, therefore the estimate of additional funds needed covers only those required for snagging operations, which are needed for maintenance of channel.

In the Annual Report for 1896, on page 1650, there is given an abstract of the work done under the head "Removing obstructions in Arkansas River, Arkansas and Kansas," and on pages 1652 to 1655 of same report there is given the location and description of all works built for the permanent improvement of the river prior to that year. Reports of the principal examinations and surveys are given in the following-named documents:

Survey from Fort Gibson to Wichita, Kans., House Executive Document No. 90, Forty-ninth Congress, first session; survey from Fort Gibson to Little Rock, House Executive Document No. 295, Forty-first Congress, second session; survey from Little Rock to Mississippi River, Annual Report of the Chief of Engineers for 1885, page 1604; report of Board of Engineers on improvement from Wichita to mouth, House Executive Document No. 234, Fiftieth Congress, first session, and Annual Report of the Chief of Engineers for 1888, page 1389; and report of Board of Engineers on examination and survey of Arkansas River with a view to its permanent improvement, House Document No. 150, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, page 2128.

July 1, 1902, balance unexpended	\$111,698.26
Received from sales	994.76
June 30, 1903, amount expended during fiscal year	112,693.02
	34,168.87
July 1, 1903, balance unexpended	78,524.15
July 1, 1903, outstanding liabilities	3,307.87
July 1, 1903, balance available	75,216.28
July 1, 1903, amount covered by uncompleted contracts	10,833.52
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	35,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Y 1.)

2. *White River, Arkansas.*—In its original condition this river was much choked by logs, snags, and drift in its lower reaches, and in its upper reaches—i. e., above Jacksonport—by gravel shoals, bowlders, and some snags.

The original project (act of March 3, 1871) was to remove snags and similar obstructions, the work being combined with similar work on Black and Little Red rivers. Act of June 23, 1874, extended the improvement to Forsythe, Mo., the project being to remove snags and bowlders and to contract the water width at shoals. During the period 1873–1884 the snagging operations on the lower river were in connection with similar work on St. Francis River, while the improvement above Jacksonport was under appropriations confined to that portion of the stream. The act of July 5, 1884, was the first independent appropriation for the river as a whole. It readopted and consolidated into one the separate projects and provided for a survey with a view to the permanent improvement of the river from Forsythe, Mo., to the mouth. The project of 1888 (Annual Report of the Chief of Engineers for 1888, p. 1406) was to deepen the water on shoals by contracting the channel and to remove rock, bowlders, and snags from the channel, the object being to obtain a channel 5 feet deep at low water from the mouth to Newport and 2 feet deep from Newport to Buffalo Shoals at an estimated cost of \$105,815, with an additional amount of \$8,000 a year for two or three years for snagging. For reasons given in the Annual Report of the Chief of Engineers for 1891, page 2049, the estimates were inadequate to accomplish the object. The act of July 13, 1892, appropriated \$53,815 to complete the project, and an additional sum of \$21,185 to be expended “in the discretion of the Secretary of War.” These funds and those appropriated since have been expended on the lines of the project of 1888, with the addition of dredging on the shoals. The act of March 3, 1899, adopted a lock and dam project for the improvement of this river above Batesville, thus reducing the scope of the former project to improving the river from the mouth to Batesville by contracting the channel, by removing rocks, bowlders, and snags, and by dredging, the expenditures to be made in the discretion of the Secretary of War.

It is not practicable to state the expenditures on this river when the work was carried on in connection with other rivers. From the sep-

arate appropriations for the whole river, or for reaches of it, to the close of the fiscal year ending June 30, 1903, there had been expended \$394,748.97. Of this amount \$4,000 was allotted to Cache River; \$11,061.46 was spent on special works at Batesville; \$166,000 was on projects prior to that of 1888; \$108,815 was for original construction under the project of 1888, and \$104,872.51 on maintenance of works and on snagging and dredging.

In a few instances the contraction works above Jacksonport gave a slight increase in channel depth, but, on the whole, there was not enough improvement in the channel to be of any material benefit to navigation; the dredging between Jacksonport and Batesville in fiscal year 1898 made a channel 3 feet deep during one low-water season, but the dredging has not been continued, no plant being available; the snagging operations have made available the natural depth in the stream. Between Jacksonport and Batesville the ruling depths in ordinary low water are approximately 20 inches; below Jacksonport it is seldom that the depths are below 3 feet; this year only one place was reported as having a less depth; that was Clarendon bar, where 2½ feet was reported as the available depth at lowest water. Forsythe, Mo. (505 miles above the mouth), is the head of navigation for steamboats; however, no boat reports going above McBees Landing (404 miles above the mouth) this fiscal year. Rafts were floated from the mouth of Roark Creek, about 20 miles above Forsythe.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year	Value.	Tons.
1894.....	\$1,043,438	45,793	1899.....	\$1,619,351	117,801
1895.....	2,494,377	73,759	1900.....	2,244,222	134,696
1896.....	2,056,991	74,882	1901.....	1,700,355	148,574
1897.....	2,435,814	73,962	1902.....	1,242,438	184,066
1898.....	1,415,013	102,337	1903.....	882,225	140,013

Fifty per cent of the tonnage reported this year was rafted saw logs and railway ties. Lumbering and kindred industries make up the bulk of the steamboat commerce, these industries alone making 89 per cent of the total commerce reported. A long period of comparatively high water, which prevented timbermen from getting out material for shipment, accounts for the reduced tonnage this year. The steamboat transportation lines were reorganized during the year, the new arrangement being a weekly packet between Rosedale and Clarendon, one between Judsonia and Augusta, one between Jacksonport and Augusta, and one between Newport and Clarendon.

The expenditures this fiscal year were for part payment for the construction of the snag boat *Quapaw* and for snagging operations. The available balance will be expended in snagging operations. The additional work needed (snagging operations) is for the maintenance of channel rather than for the purpose of making extension of benefits.

On page 1668 of Annual Report of the Chief of Engineers for 1896 there is given the location of all the principal works built for the improvement of this river. Report of survey from Forsythe, Mo., to the mouth, with plans for improvement, is given in Annual Report of the Chief of Engineers for 1888, page 1406.

July 1, 1902, balance unexpended	\$22,912.30
June 30, 1903, amount expended during fiscal year	10,846.27
July 1, 1903, balance unexpended	12,066.03
July 1, 1903, outstanding liabilities	176.87
July 1, 1903, balance available	11,889.16

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Y 2.)

3. *Upper White River, Arkansas.*—Earlier works on this portion of White River were made under appropriations for improving White River, Arkansas, and have been fully reported upon under that head.

The original condition of the river and previous projects for its improvement are also reported there.

The existing project, adopted March 3, 1899, is based on a report printed in Annual Report of the Chief of Engineers for 1897, page 1992, and is to provide slack-water navigation from Batesville, Ark., to Buffalo Shoals, 89 miles, by 10 fixed dams with concrete locks. The locks are to be 175 feet between hollow quoins and 36 feet wide, with a depth of about 4 feet on the lower miter sills. The estimated cost is \$1,600,000, based on having funds sufficient to construct one lock and dam complete each working season.

To the close of the fiscal year ending June 30, 1903, there has been expended on this work \$394,441.51.

The abutment for Dam No. 1 and the lock were built in fiscal year 1901; the lock house, land and guide cribs, and the dam this fiscal year. The abutment was flanked and totally destroyed during a freshet in November, 1902. The abutment for Dam No. 2, the lock (exclusive of the gates), and the lock house were built in fiscal years 1901 and 1902. This fiscal year the lock gates, the upper land crib and the upper guide crib, and 250 linear feet of dam were built. The balance available will be expended in completing Lock and Dam No. 1 and in carrying forward the construction of Lock and Dam No. 2. The additional funds recommended are for the completion of Lock and Dam No. 2.

As Lock No. 1 was in operation only a few days (October 16 to November 25), navigation this year has been governed by the conditions in the open river. It was suspended on account of low water from July 15 to November 15, 1902, and from April 20 to May 12, 1903.

Forsythe, Mo. (204 miles above Batesville), is the head of steamboat navigation, but no boat reports going above McBees Landing (104 miles above Batesville) this fiscal year. Rafts were floated from the mouth of Roark Creek, 25 miles above Forsythe.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1899	\$548,385	9,069	1902	\$758,040	27,472
1900	1,260,716	39,258	1903	737,080	16,815
1901	689,856	28,522			

Twenty per cent of the commerce reported was rafted railway ties and cedar. Full report of rafted commerce as well as of steamboat commerce was not received. If the business done this year by those failing to report be assumed to be equal to that of last year the total commerce for this year is approximately 29,000 tons.

When the report^a on the examination of this stream, having in view the determination of the proper method of improvement, was submitted recommending improvement by locks and dams, the Chief of Engineers, in his indorsement on the report, said:

This river is capable of improvement from the engineer's point of view, but the information at hand does not convince me that the needs of commerce justify the expenditure of public money on it at this time. In the words of the law I must therefore say that in my judgment the stream is not worthy of improvement.

In the report^b of the survey looking toward its improvement by locks and dams the district officer said:

In my opinion the river is worthy of the proposed improvement and that the same is justified by the commerce that will be developed. That portion of Arkansas bordering on upper White River is rich in manganese and zinc ores and marble in addition to the lumber and agricultural interests and has no outlet.

A railway is now built along this river for more than the entire distance covered by the project. The railway affords the outlet that did not exist when the report on the survey of the stream was made. It is the opinion of the present district officer that there is little prospect of any material increase in river commerce, which is now and always has been small, as reference to the tabulation of commercial statistics will show. Because of the transportation facilities now afforded the upper White River Valley he is of the opinion that this stream is unworthy of further improvement by locks and dams and recommends the discontinuance of appropriations for it after the completion of Locks and Dams Nos. 1 and 2 has been provided for. I concur in his opinion and recommendation. The amount estimated as necessary for the completion of Lock and Dam No. 2 is \$12,500 in addition to the balance available July 1, 1903.

July 1, 1902, balance unexpended.....	\$279, 181. 15
Received from sales	20. 50
	279, 201. 65
June 30, 1903, amount expended during fiscal year	93, 643. 16
	185, 558. 49
July 1, 1903, balance unexpended.....	185, 558. 49
July 1, 1903, outstanding liabilities.....	18, 634. 65
	166, 923. 84
July 1, 1903, balance available.....	166, 923. 84
	23, 015. 98
July 1, 1903, amount covered by uncompleted contracts.....	23, 015. 98
{ Amount (estimated) required for completion of existing project.....	1, 020, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	12, 500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Y 3.)

4. *Buffalo Fork of White River, Arkansas.*—Act of Congress approved March 3, 1899, adopted a project for improvement of this

^a House Document No. 98, Fifty-fourth Congress, first session.

^b House Document No. 78, Fifty-fourth Congress, second session.

stream by cutting overhanging timber and removing from the shoals the loose and solid rock projecting above the general plane of the shoals, the work to extend from the mouth to Rush Creek, 24½ miles. The estimated cost was \$3,500.

To June 30, 1903, the sum of \$3,441.50 was expended, with which the natural channel was made available for flatboats and rafts. No further work is intended.

July 1, 1902, balance unexpended	\$105. 00
June 30, 1903, amount expended during fiscal year	46. 50

Amount returned to Treasury	58. 50
-----------------------------------	--------

5. *Cache River, Arkansas.*—In its original condition this river was much obstructed by snags, drift, and overhanging timber. The low-water depth on the controlling shoals was 6 to 8 inches.

The original project, adopted by act of August 11, 1888, was to remove logs, snags, and overhanging timber from the mouth to River-side (102 miles). The amount expended on this project was \$9,000.

Acts of August 18, 1894, and June 3, 1896, each authorized the Secretary of War to expend \$2,000 of the White River appropriations on this stream. These funds were expended in snagging operations from the mouth of the river to James Ferry, 79 miles, in accordance with a project adopted in 1888. Acts of March 3, 1899, and June 13, 1902, made independent appropriations for this stream. These were expended in snagging operations between the mouth of the river and James Ferry along the lines of the 1888 project, under which there has been expended \$6,990 to June 30, 1903, the entire expenditure being for maintenance of channel. These operations were of material benefit to commerce by lengthening the navigable period and by making available the full natural depths of the stream. The river is not navigable during low water, because of insufficient depth, which during the fall of 1902 was only about 10 inches over the shoals. Navigation was suspended for five months during this year. Greys Bridge, 95 miles above the mouth, is the head of steamboat navigation. Rafts are run from one hundred or more miles farther up.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1896.....	\$25,494	12,603	1900.....	\$29,961	11,215
1896.....	62,483	20,748	1901.....	30,100	10,374
1897.....	108,460	34,990	1902.....	40,301	15,676
1898.....	36,635	10,193	1903.....	109,681	16,843
1899.....	52,936	7,667			

Sixty-four per cent of the commerce reported this year was rafted. Railway ties and rough staves made up the bulk of the steamboat commerce.

Reports of the more recent preliminary examinations of this river are given in Annual Report of the Chief of Engineers for 1887, page 1547, and in Annual Report of the Chief of Engineers for 1895, page 2037.

July 1, 1902, balance unexpended	\$2,000.00
June 30, 1903, amount expended during fiscal year.....	1,990.00
July 1, 1903, balance unexpended	10.00
July 1, 1903, outstanding liabilities	10.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
{ (See Appendix Y 4.)	
{ 2,000.00	

6. *Black River, Arkansas and Missouri.*—In its original condition this river below the mouth of Current River had, at ordinary low water, a controlling depth of 2 to 2½ feet on the shoals, but this was not available on account of snags and similar obstructions. Above the mouth of Current River navigation was practically impossible at ordinary low stages and no rafting was possible above the Arkansas and Missouri State line.

The original project, adopted by act of June 14, 1880, contemplated removing logs, etc., cutting down shoals by means of wing dams, and closing some of the most troublesome sloughs. The estimated cost was \$80,800. The only modification of the project has been that of changing the estimate to \$8,000 a year for maintenance. The district officer recommends that this be increased to \$15,000.

To June 30, 1903, there had been expended on this work \$121,452.13.

Navigation has been made possible all the year to Poplarbluff, Mo. The minimum depths on the shoals above Current River this fiscal year were 18 to 20 inches; below Current River the depths were 2½ feet. Poplarbluff, Mo., is the head of navigation.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894.....	\$956,982	87,536	1899.....	\$529,336	83,404
1895.....	1,085,415	132,433	1900.....	965,961	129,698
1896.....	891,437	111,278	1901.....	989,635	185,714
1897.....	1,704,799	111,611	1902.....	919,767	166,213
1898.....	788,640	115,612	1903.....	685,649	138,181

Fifty-six per cent of the commerce reported this year was made up of rafted saw logs, railway ties, and piling. Lumbering industries produced the bulk of the steamboat commerce also. A long period of comparatively high water reduced the timber shipments considerably. Full report was not received of the rafted commerce.

The expenditures this fiscal year were for part payment for the snag-boat *Quapaw* and for snagging operations. The balance available will be expended in snagging operations and care of plant. The additional amount recommended is for snagging operations which are required to maintain the channel and for new hull for the hand-propelled snag boat *Riverside*.

On page 1686 of Annual Report of the Chief of Engineers for 1896 is given report of all work done up to and including that year. The report of the examination, upon which the present project is based, is given in Annual Report of the Chief of Engineers for 1880, page 1326.

July 1, 1902, balance unexpended	\$21,706.54
June 30, 1903, amount expended during fiscal year	10,958.67
July 1, 1903, balance unexpended	10,747.87
July 1, 1903, outstanding liabilities	1,307.72
July 1, 1903, balance available	9,440.15
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
16,750.00	
(See Appendix Y 5.)	

7. *Current River, Arkansas and Missouri.*—The original condition of this stream was such that no steamboat navigation above the mouth of Little Black River was attempted except when the river was at high stages. Below Little Black River navigation was suspended when the river was below medium stage. The natural depths were not available on account of snags and leaning trees.

Although the United States made some improvements to this stream in 1873, and again in 1882 and 1883, the regular improvement of it was not undertaken until act of Congress of August 18, 1894, adopted a project for its improvement from Vanburen, Mo., to the mouth by snagging operations and by contracting the channel at the worst shoals by wing dams, at an estimated cost of \$10,000. The appropriation of June 3, 1896, completed the amount originally estimated for the completion of the project, and all operations since then have been under estimates for maintenance. No wing dams have been built, all operations having been confined to snagging.

To June 30, 1903, there has been expended on this river \$24,908.72, \$7,000 of which was in the early work mentioned above, leaving \$17,908.72 as the amount expended on the existing project. Of this latter amount, \$7,908.72 was for maintenance.

The channel depths at ordinary low water are 3 feet from the mouth to Johnsons, 25 miles; 2 feet from Johnsons to Little Black River, 7 miles; 16 inches from Little Black River to Pitmans Landing, 9 miles, and 12 inches from Pitmans Landing to Tucker Bay, 31 miles. From there to Vanburen, 23 miles, the channel depths are slightly less.

Pitmans Landing, near the State line between Arkansas and Missouri, is generally spoken of as the head of steamboat navigation, but boats can not go so far up all the year. Small gasoline boats occasionally ply the stream as far up as Vanburen, and either rafting or driving of logs is carried on all the year over the river below that point.

The expenditures this fiscal year have been for part payment for the snag boat *Quapaw* and for operating the snag boat *Riverside*. The available funds will be expended in operating those boats.

The work of the snag boats has made navigation safer and easier below Pitmans Landing. The improvement made in the channel from Pitmans Landing to Buffalo Creek (12 miles above Doniphan, Mo., and 65 miles above the mouth of the river) during the fiscal year 1896 has not been maintained. A snag boat is now at work in that section of the stream and will remain there until August 15, when it will be transferred to another river, the funds available not being sufficient to keep the boat at work any longer. The Annual Report of the Chief of

Engineers for 1896 gives the amount necessary for maintenance of the channel then cleared as \$2,000 annually, but further experience with this stream shows that the amount there given is not sufficient. Under the present conditions the hand-propelled boat should work above the mouth of Little Black River three months and the steam-propelled boat below the mouth of Little Black River two months each year, if the channel is to be maintained. To operate those boats for that period of time during the fiscal year ending June 30, 1905, and to care for them during the period of no operations \$5,000 is required in addition to the amount now available.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1895.....	\$362, 447	31, 205	1900.....	\$578, 834	65, 043
1896.....	227, 291	29, 867	1901.....	234, 555	64, 102
1897.....	581, 528	17, 078	1902.....	165, 766	37, 185
1898.....	306, 216	52, 417	1903.....	142, 899	45, 309
1899.....	239, 869	43, 050			

Eighty-seven per cent of the commerce reported this year was rafted saw logs, railway ties, and square timber. Full report of the rafted commerce was not received. No steamboat reported going above the mouth of Little Black River, to which point navigation was possible all the year. Saw logs and railway ties were rafted from all along the stream.

Report of preliminary examination of the river from Vanburen, Mo., to the mouth, being that portion covered by the approved project, is given in Annual Report of the Chief of Engineers for 1891, page 2065, and with maps in House Executive Document No. 157, Fifty-first Congress, second session. Report of a subsequent examination of the same portion of the river is given in Annual Report of the Chief of Engineers for 1893, page 2128, and in House Executive Document No. 227, Fifty-second Congress, second session.

July 1, 1902, balance unexpended.....	\$6, 912. 97
June 30, 1903, amount expended during fiscal year.....	2, 921. 69

July 1, 1903, balance unexpended.....	3, 991. 28
July 1, 1903, outstanding liabilities.....	748. 58

July 1, 1903, balance available.....	3, 242. 70
--------------------------------------	------------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Y 6.)

8. *St. Francis and L'Anquille rivers, Arkansas.*—(a) *St. Francis River.*—In its original condition this stream was not navigable above Lesters Landing at any stage; between Lesters Landing and Marked Tree navigation was possible at high stages only, and below Marked Tree it was difficult at medium and lower stages and impossible at extreme low water.

The original project, adopted by act of March 3, 1871, contemplated improvement from the mouth to Wittsburg by snagging operations. For the period 1873–1882 the appropriations were made for this work

in connection with White River, Arkansas. By act of June 14, 1880, appropriation was made for improving the river from Wittsburg to Lesters Landing, the project for the expenditure of this appropriation being to cut a channel through "The Lake" and clear the river of obstructions by snagging operations. Appropriation made by act of July 5, 1884, was the first separate appropriation for the entire river. The act did not state the limits within which it was to be applied. Under it snagging operations were carried on to the town of St. Francis, Ark., and several of the sloughs or side channels were closed. When the improvement of St. Francis River, Missouri, was begun (act of August 11, 1888), Kennett, Mo., was taken for the upper limit of this work, making the existing project—

remove logs, drifts, and snags from the channel, and overhanging timber from the banks from the mouth to Kennett, Mo., and to close the chutes and sloughs in the Sunk Lands, so as to make the river navigable at high stages to Kennett, Mo., at medium stages to Marked Tree, and at low stages to a point 30 miles below Madison, Ark., the estimated cost being \$8,000 annually.

(b) *L'Anguille River*.—By acts of June 18, 1878, March 3, 1879, and June 14, 1880, a total of \$17,000 was appropriated for snagging operations on L'Anguille River to Marianna. This was finally expended in fiscal year ending June 30, 1887. Act of June 13, 1902, revived this work and included it with St. Francis River.

There has been expended on these rivers, to June 30, 1903, \$88,804.17, which amount, however, does not include the expenditures on St. Francis River while it was combined with White River, as those expenditures can not be determined.

By the early operations the St. Francis River between Wittsburg and Lesters Landing was improved to such an extent that boats could reach the latter-named place on the same stage that they could the former. By subsequent operations the period of navigation below Wittsburg was lengthened about two months, and above Lesters Landing a fair high-water channel was made. The operations this fiscal year made available for navigation purposes the full natural depths of the St. Francis River from its mouth to Madison, and those of the L'Anguille River up to Marianna. During periods of low water neither stream is navigable, there not being sufficient depth of water over the shoals. Marianna is the head of navigation on L'Anguille River. The head of navigation on St. Francis River is near Wappapello, Mo., about 100 miles above Kennett, Mo., the upper limit of the portion of the river covered by this project. Lying between Kennett, Mo., and Foot of Lake, 80 miles below, are the Sunk Lands, through which the river spreads over a large area of country becoming of the nature of swamp. This section of the stream permits the passage of boats only during the highest stages, and, except for a small amount of rafting, its only benefit to commerce is to afford a passageway for boats from the St. Francis River in Missouri to the St. Francis River in Arkansas.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894.....	\$98,375	19,763	1899.....	\$315,459	27,892
1895.....	321,439	38,107	1900.....	194,237	45,065
1896.....	401,457	67,740	1901.....	272,609	57,102
1897.....	1,117,891	97,848	1902.....	269,190	85,831
1898.....	237,481	23,819	1903.....	294,495	88,035

Ninety-seven per cent of the commerce reported was saw logs transported in barges towed by steamboats or in rafts floated with the current. The rafted saw logs make up 50 per cent of the total commerce.

The balance available will be expended in snagging operations, mainly between Madison, Ark., and Marked Tree, 107 miles above. The additional funds needed are for procuring a new hull for the snag boat and for operating the boat.

Reports of examinations and of surveys of these rivers are printed, as follows:

With map, in House Document No. 125, Fifty-fifth Congress, second session.

Without map, in Annual Report of the Chief of Engineers, 1898, page 1678.

July 1, 1902, balance unexpended	\$9, 005. 15
June 30, 1903, amount expended during fiscal year	4, 809. 32
July 1, 1903, balance unexpended	4, 195. 83
July 1, 1903, outstanding liabilities	201. 39
July 1, 1903, balance available	3, 994. 44

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	6, 000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	(See Appendix Y 7.)	

9. *St. Francis River, Missouri.*—In is original condition this river was not navigable at low stages on account of shoals, snags, and similar obstructions. At higher stages it was difficult on account of snags and overhanging timber.

The original project, adopted by act of Congress approved August 11, 1888, contemplated improvement from Greenville, Mo., to Kennett, Mo., by snagging operations and the removal of shoals about 12 miles below Greenville, at an estimated cost of \$7,300, which was not sufficient. After \$20,500 had been expended on this work it was discontinued.

The existing project, adopted by act of Congress approved June 13, 1902, is to "clear the river of snags, drifts, and overhanging timber from the head of the Sunk Lands to Chalk Bluff, and to confine the river to one channel; to remove the snags, drifts, and overhanging timber that interfere with navigation at medium and high stages of water from Chalk Bluff to Poplin, Mo.," at an estimated cost of \$11,200, and \$2,000 per year to remove the annual accumulation of snags after the proposed improvement is once accomplished.

To June 30, 1903, \$6,323.64 has been expended on the existing project.

Under the previous projects the navigation periods were lengthened and navigation rendered easier between Kennett, Mo., and Poplin, Mo., 84 miles; and inside of this limit the full depth of the stream (12 inches at lowest water) was rendered available for navigation between St. Francis, Ark., and Freeman Place, 19 miles above. These benefits were lost before the adoption of the present project. Operations this fiscal year have opened a fairly good channel for navigation at ordinary stage between St. Francis, Ark., and Poplin. The head of navigation

for boats is in the vicinity of Wappapello, about 16 miles above the limit of the existing project. The river is not navigable during the lowest stages.

Commercial statistics, year ending May 31.

Year.	Value.	Tons.	Year.	Value.	Tons.
1894.....	\$145, 118	35, 826	1899.....	\$72, 601	19, 359
1895.....	79, 091	23, 326	1900.....	65, 647	26, 156
1896.....	135, 029	35, 497	1901.....	56, 935	13, 805
1897.....	75, 425	23, 306	1902.....	13, 092	6, 420
1898.....	72, 873	23, 170	1903.....	12, 880	5, 022

All commerce reported this year was rafted saw logs and piling. There were no steamboats on the river during the year. A gasoline boat, 50 feet long, 15 feet wide, and 3 feet deep, is now building at St. Francis.

The balance available will be expended in snagging operations.

The district officer expresses a doubt as to the worthiness of this stream and makes no recommendation for the fiscal year ending June 30, 1905. He gives it as his opinion that \$30,000, to be expended at the rate of \$5,000 a year, is needed to open up the river in a satisfactory manner, but states that neither the present nor prospective commerce justifies this expenditure.

Reports of examinations and surveys of this stream are printed in the following: Annual Reports of the Chief of Engineers for 1873, page 476; 1881, page 1481; 1887, page 1549; 1895, page 2040; 1897, page 1999, and in House Document No. 82, Fifty-fourth Congress, second session, and in Annual Report of the Chief of Engineers for 1900, page 2618, and House Document No. 41, Fifty-sixth Congress, first session.

July 1, 1902, balance unexpended	\$10, 000. 00
June 30, 1903, amount expended during fiscal year	6, 323. 64
July 1, 1903, balance unexpended	3, 676. 36
July 1, 1903, outstanding liabilities	775. 26
July 1, 1903, balance available	2, 901. 10
Amount (estimated) required for completion of existing project	1, 200. 00
(See Appendix Y 8.)	

REMOVING SNAGS AND WRECKS FROM MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN OHIO AND MISSOURI RIVERS; PREVENTION OF MISSISSIPPI RIVER FROM BREAKING THROUGH INTO CACHE RIVER AT BEECHRIDGE, ABOVE CAIRO, ILL.

This district was in the charge of Maj. Thos. L. Casey, Corps of Engineers. Division Engineers, Col. Amos Stickney, Corps of Engineers, to February 13, 1903, and Col. O. H. Ernst, Corps of Engineers, since that date.

1. Removing snags and wrecks from the Mississippi River below the mouth of the Missouri River.—Before this work was begun the navigation of the river was seriously interfered with by numerous snags,

logs, etc., which had lodged in the channel, and to which additions were made with each rise of the river. A large number of wrecked flatboats, barges, steamboats, and other river craft was found in the navigable channels and formed a continual menace to life and property.

For the removal of these obstructions appropriations were made as early as 1824. The project adopted consisted of building boats suitable for removing snags, logs, drift heaps, etc., and operating them whenever the stage of water was favorable and funds were available.

The amount expended upon this work on the reach of the river below the mouth of the Missouri prior to 1879 can not now be definitely ascertained, for the reason that during much of the time appropriations were made at irregular intervals in lump sums, to be applied to several streams as their needs or the terms of the law might require. From March 3, 1879, when the first specific appropriation was made, up to June 30, 1902, there had been expended \$1,726,889.86. This expenditure made great improvement in the navigation of the river and lessened the danger to boats.

Two steel snag boats were employed in removing the obstructions to navigation between the mouth of the Missouri River and Natchez, and during the year 1,552 snags were pulled, 2 drift piles removed, 6,895 trees cut, and 10,325 miles patrolled.

An annual appropriation, not to exceed \$100,000, for carrying on this work was made by the act of August 11, 1888. Under this appropriation the two snag boats will continue to patrol the river and remove obstructions where necessary.

For recapitulation of commercial statistics reference should be made to the report upon improving the Mississippi River between the Ohio and Missouri rivers.

Amount drawn under section 7, act of August 11, 1888.....	\$72, 587. 48
June 30, 1903, amount expended during fiscal year	72, 587. 48
July 1, 1903, amount available for fiscal year 1903-4	100, 000. 00

(See Appendix Z 1.)

2. *Mississippi River between Ohio and Missouri rivers.*—In its original condition the navigable channel of this section of the Mississippi River had a natural depth in many places of only 3½ to 4 feet at low water. The channels were divided by islands, which formed sloughs and secondary channels or chutes, through which a great deal of the volume of the flow was diverted, to the detriment of navigation.

The first effort to improve this condition began in 1872 and was continued for a number of years as appropriations were made, the works consisting of dikes and dams of brush and stone, erected with a view to confining the low-water volume to a single channel, and of revetments to hold and preserve the banks where necessary or advisable to do so.

The present project is a continuation of the plan adopted in 1881.

It contemplates confining the flow of the river to a single channel having an approximate width below St. Louis of 2,500 feet at bank-full stage, the natural width in many places being a mile or more at mean high water. This result is to be attempted by closing sloughs and secondary channels and by building out new banks where the natural width is excessive, using for this purpose permeable dikes or

hurdles of piling that collect and hold the solid matter that is carried in suspension or rolled on the bottom by the river. The banks, both old and new, are to be revetted or otherwise protected where necessary to secure permanency. Pending the completion of the permanent improvement, the low-water channel is to be improved each season by the use of dredges and other temporary expedients.

The object of the improvement is to obtain eventually a minimum depth at standard low water of 6 feet from the mouth of the Missouri to St. Louis and of 8 feet from St. Louis to the mouth of the Ohio.

The original estimate of the cost of the improvement, as revised in 1883, is \$16,397,500.

The total amount expended to June 30, 1903, was \$10,037,957.77, exclusive of \$180,000 allotted by acts to projects for improvement between the Illinois and Missouri rivers, including Alton Harbor.

The amount expended during the fiscal year ending June 30, 1903, includes \$48,151.76 expended for temporary expedients. The total amount thus far expended for temporary channel improvements is \$627,425.85, much of which has been for plant that is now on hand and available for future work. The approximate value of this plant is \$194,677.10.

The result of the expenditure of this amount has been the partial improvement of the entire reach of the river from St. Louis to Cairo. During the past year there was at all times during open navigation a channel depth of 6 feet or more throughout this reach. The river attained a low-water stage of 3.5 feet above standard low water.

With the present appliances and such others as may be developed for the temporary improvement of low-water channels, it is expected that a navigable depth of at least 6 feet will be maintained between St. Louis and Cairo during all stages, while the river is open to navigation, until the projected depth can be obtained throughout by the extension and completion of the permanent works.

It seems now certain that the procuring of satisfactory channels at all seasons of open navigation is merely a matter of providing funds in sufficient amounts to do the work economically. The local officer states that \$150,000 is required annually for temporary low-water operations alone.

The act for sundry civil expenses of the Government approved March 3, 1903, appropriated \$650,000 for continuing the improvement of the reach of the Mississippi River from the mouth of the Ohio to and including the mouth of the Missouri River.

Recapitulation of commercial statistics.

	1899.	1900.	1901.	1902.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Receipts and shipments at St. Louis.....	669,815	757,590	672,076	641,182
Transferred by ferries at St. Louis.....	5,036,730	5,218,967	5,860,592	5,731,635
Shipped from landings between St. Louis and Cairo..	30,716	52,640	30,978	17,179
Total.....	5,737,261	6,029,197	6,563,646	6,389,996

July 1, 1902, balance unexpended	\$733, 729. 06
November 25, 1902, received from sale of condemned property	2, 386. 09
Amount appropriated by sundry civil act approved March 3, 1903	650, 000. 00
June 30, 1903, amount expended during fiscal year	1, 386, 115. 15
July 1, 1903, balance unexpended	889, 526. 11
July 1, 1903, outstanding liabilities	8, 749. 90
July 1, 1903, balance available	^a 880, 776. 21
July 1, 1903, amount covered by uncompleted contracts	107, 228. 71
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	650, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Z 2.)

3. *To prevent the Mississippi River from breaking through into the Cache River at or near a point known as Beechridge, a few miles above Cairo, Ill.*—The sundry civil act approved June 4, 1897, contained an item providing for this work, which reads as follows:

For the purpose of preventing the Mississippi River from breaking through into the Cache River at or near a point known as Beach Ridge [Beechridge], a few miles north of Cairo, whereby the national cemetery at Mound City, at the mouth of the Cache River, and the marine hospital at Cairo would be in imminent danger of destruction, the sum of one hundred thousand dollars, or so much thereof as may be necessary, is hereby appropriated, to be immediately available.

The project for this work not having been based upon a survey under the Engineer Department, and the extent of the work contemplated being unknown, an estimate of its total cost could not then be given. From a study of the conditions involved, it seemed that the object of the appropriation could best be carried out by revetting as great a length of the bank of the Mississippi River in the vicinity of Beechridge railroad station as the funds would cover.

The project for the expenditure of the amount appropriated contemplated commencing at a suitable point on the bank of the river a short distance above the nearest point to Beechridge station, building a short hurdle out into the stream to protect the head of the revetment, and then revetting the banks in the usual manner down as far as the funds would suffice.

Under this project and during the previous fiscal years a hurdle 275 feet long was constructed and 9,435 linear feet of subaqueous mattress was placed. This mattress was about 130 feet wide, and followed the form of construction used in this section of the Mississippi River, the upper 440 feet having been built of brush and the remainder of lumber. The bank above the mattress was revetted with stone to the

^a Distributed under subheadings as follows:

For revetting bank opposite mouth of Missouri River, act of March 3, 1899	\$30, 772. 84
For from mouth of Ohio River to mouth of Missouri River, acts of June 13, 1902, and March 3, 1903	818, 293. 41
For protection of bank on Missouri side and to deepen and straighten channel at Wittenberg, Mo., act of March 3, 1899	10, 000. 00
For allotment for Sawyers Bend, act of June 13, 1902	21, 709. 96

880, 776. 21

33-foot stage, Cairo gauge, from the upper end to a length of 5,000 feet, and to the 25-foot stage for the remaining 4,435 feet.

The protection was repaired during the fiscal year ending June 30, 1903, as far as practicable, which was for a distance of 9,000 feet from its head.

The total available balance was expended on this work during the past year.

No further appropriation is asked for this work.

For recapitulation of commercial statistics reference should be made to report upon improvement of Mississippi River between Ohio and Missouri rivers.

July 1, 1902, balance unexpended	\$6, 430. 56
June 30, 1903, amount expended during fiscal year	6, 430. 56

(See Appendix Z 3.)

OPERATING SNAG BOATS AND DREDGE BOATS ON UPPER MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER BETWEEN MOUTH OF MISSOURI RIVER AND ST. PAUL, MINN., AND OF LA CROSSE HARBOR, WISCONSIN; OPERATING AND CARE OF GALENA RIVER IMPROVEMENT, ILLINOIS, AND OF ILLINOIS AND MISSISSIPPI CANAL AROUND THE LOWER RAPIDS OF ROCK RIVER, AT MILAN, ILL.

This district was in the charge of Maj. C. McD. Townsend, Corps of Engineers, to March 31, 1903, and in the charge of Maj. Jas. L. Lusk, Corps of Engineers, since that date. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. *Operating snag boats and dredge boats on upper Mississippi River.*—By the river and harbor act of August 11, 1888, provision was made for securing the uninterrupted work of snag boats and dredge boats on the upper Mississippi River under a permanent appropriation, the sum so expended not to exceed \$25,000 annually.

During the past fiscal year the snag boat *Colonel A. Mackenzie* was employed from July 1 to November 13, 1902, and from April 13 to June 30, 1903, in removing snags and other obstructions and otherwise assisting interests of navigation between Minneapolis and the mouth of Missouri River. Dredge *Ajax* removed deposits at the steamboat landing at Fulton, Ill. Dredge *Vulcan* removed an obstructing wing dam near Wilds Landing and a large amount of sand from the channel at mouth of Beef River and foot of Blackbird Slough. Dredge *Phoenix* deepened the approach to the steamboat landing at Hamburg, Ill., and improved the harbor at Burlington, Iowa, by removing extensive deposits of mud, sand, and gravel.

The total amount expended for snag-boat service to June 30, 1903, was \$899,584.

The total amount of freight transported on the upper Mississippi River during the calendar year 1902 was about 1,900,000 tons, and the ton-miles 527,140,000; in 1901, 2,125,000 tons, and 531,250,000 ton-miles.

The amount expended during the fiscal year ending June 30, 1903, was \$25,000.

(See Appendix A A 1.)

2. *Mississippi River between Missouri River and St. Paul, Minn.*—Under this head is carried on the improvement of through navigation

and also such special harbor or levee work as is provided for by Congress. Systematic work was begun in 1878, and such good results have been secured as to demonstrate that with a continuance of operations, under liberal appropriations, the low-water channel of the Mississippi River between St. Paul and the Missouri River can be made sufficiently deep, available, and permanent to satisfy the demands of commerce.

The original condition of the channel between the Missouri River and St. Paul was such that in low stages the larger boats were unable to proceed farther upstream than La Crosse or Winona, and in many seasons at points much lower down their progress was checked or seriously hindered.

The original project for the improvement, adopted in 1879, which has not been materially changed, proposed the contraction of the channel or waterway by means of wing and closing dams to such an extent as, by means of the scour thereby caused, to afford a channel of sufficient width, and of a depth of 4.5 feet at low water, to be eventually increased to 6 feet by further contraction.

There was expended on the improvement to June 30, 1903, the sum of \$10,448,559.97, of which about \$500,000 has been applied to maintenance. At that date, and for many years previous, the condition of the channel was such as to permit the passage of the largest river boats at very low stages through to St. Paul.

During the past year work has been carried on by hired labor and use of Government plant between Wabasha and Bellevue, at Rock Island Rapids, and between Hannibal and the Missouri River, and under formal contract between Rock Island and Hannibal. At all localities where work was performed good results were obtained.

The navigation interests are very large and important. The amount of freight carried during the season of 1902, including logs and lumber, was approximately 1,900,000 tons, and the ton-miles 527,140,000, this being a decrease from 1901 of 225,000 tons freight, and 4,110,000 ton-miles.

There was expended for channel improvement during the past year \$279,649.78, and an increased depth was obtained at several localities. The maximum draft that could be carried June 30, 1903, from the Missouri River to St. Paul, at mean low water (stage 1.5 above extreme low water) was, as nearly as could be ascertained, 4.5 feet.

The river and harbor act of June 13, 1902, directs the Secretary of War to cause an examination to be made of the Mississippi River at the foot of Des Moines Rapids, near Keokuk, Iowa, to determine whether a dam constructed at the foot of said rapids would be a benefit or impediment to the navigation of said river; and an examination to be made of the locks of the Des Moines Rapids Canal to determine the necessity for and cost of enlarging such locks. Report on the subject dated December 2, 1902, is submitted herewith as Appendix A A 7.

Reports on examinations and surveys of localities on this section of the river, which were authorized by section 14 of the act of June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$459,820.75
Amount appropriated by sundry civil act approved March 3, 1903	400,000.00
June 30, 1903, amount expended during fiscal year	859,820.75
July 1, 1903, balance unexpended	300,758.37
July 1, 1903, outstanding liabilities	559,062.38
July 1, 1903, balance available	8,742.57
July 1, 1903, amount covered by uncompleted contracts	550,319.81
July 1, 1903, amount covered by uncompleted contracts	139,670.59
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance available July 1, 1903	400,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

(See Appendix A A 2.)

3. *Operating and care of Des Moines Rapids Canal and dry dock.*—

During the past fiscal year the Des Moines Rapids Canal was open for navigation 235 days, during which time there passed through it 692 steamboats and 212 barges, carrying 33,382 passengers, 14,170 tons of merchandise, and 23,921 bushels of grain. There also passed through the canal 18,940,636 feet B. M. of lumber, 2,850,000 feet of logs, 4,550,500 shingles, and 2,229,900 laths. This is about equal to the statement of the previous year, but the business of both years, especially in logs and lumber, was made smaller by prevailing high stages of water, which permitted most of the rafts and many boats to pass over the rapids instead of through the canal. The draft afforded by the canal is 5 feet at extreme low water, which may be increased to 6 feet at high stages. There are three locks, having an available length of 325 feet and width of 78.5 feet.

The dry dock was in constant use during the whole year.

The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was \$40,623.37.

(See Appendix A A 3.)

4. *Operating and care of Illinois and Mississippi Canal around the lower rapids of Rock River, at Milan, Ill.*—This portion of the canal is $4\frac{1}{2}$ miles in length, surmounting a fall of 18 feet, and was formally opened to navigation April 17, 1895. During the past fiscal year the canal was open for navigation 252 days, during which time there passed through it 753 boats and barges, carrying 1,333 tons of freight and 1,952 passengers, showing a small increase in traffic over the previous year.

The draft afforded by the canal is 7 feet. The locks, three in number, have a length of 170 feet between miter sills and a width of 35 feet. The cost of operating and care of the canal is provided for by an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was \$11,398.94.

(See Appendix A A 4.)

5. *Operating and care of Galena River improvement, Illinois.*—This improvement, consisting of a lock and dam in the Galena River, was purchased by the United States in March, 1894, under provisions of act of September 19, 1890, at a cost of \$100,000.

During the past fiscal year the lock was open for navigation 235 days, in which time there passed through it 1,058 boats and barges,

carrying 5,452 passengers and 616 tons of merchandise. This traffic is very small and about the same as that of the previous year.

The draft that can be carried at extreme low water is 2 feet, as limited by the depth on the lower miter sill of the lock, which has an available length of 307 feet and width of 52 feet.

The cost of operating and care of the improvement is provided for under an indefinite appropriation made by act of July 5, 1884.

The amount expended during the past year was \$2,937.27.

(See Appendix A A 5.)

6. *La Crosse Harbor, Wisconsin.*—The approved project contemplates the construction of a lateral bulkhead, a cross dam, and a certain amount of filling between bulkhead and shore.

The full amount of the estimate, \$17,000, has been appropriated, and no further funds are asked for.

The amount expended to June 30, 1903, is \$15,035.65.

During the fiscal year 1901 the bulkhead and cross dam were completed. In 1902 dredged material to the amount of 84,000 cubic yards was placed within the bulkhead. In 1903 the levee was graded and the stone relaid over an area of 17,000 square feet.

July 1, 1902, balance unexpended	\$3, 178.95
June 30, 1903, amount expended during fiscal year	1, 214.60

July 1, 1903, balance unexpended	1, 964.35
--	-----------

(See Appendix A A 6.)

RESERVOIRS AT HEADWATERS OF MISSISSIPPI RIVER; IMPROVEMENT OF MISSISSIPPI RIVER FROM ST. PAUL TO MINNEAPOLIS, MINN., OF RIVERS IN WISCONSIN AND MINNESOTA TRIBUTARY TO MISSISSIPPI RIVER, OF WARROAD RIVER, MINNESOTA, AND OF RED RIVER OF THE NORTH, MINNESOTA AND NORTH DAKOTA.

This district was in the charge of Maj. R. L. Hoxie, Corps of Engineers. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. *Mississippi River between St. Paul and Minneapolis, Minn.*—In its natural condition this channel in its upper portions can be navigated at low water only by very small boats, and at higher stages the current is so swift in places as to make all navigation difficult. The improvement of this section of the river by the construction of locks and dams was inaugurated by the river and harbor act of August 18, 1894, which provided for commencing the construction of Lock and Dam No. 2, located near Meekers Island. The river and harbor act approved March 3, 1899, authorized the completion of Lock and Dam No. 2, together with Lock and Dam No. 1, under continuing appropriation, at a total cost, for both locks and dams, of \$1,166,457.

A Board of Engineers, in a report submitted April 22, 1901, proposed certain modifications of plan which will increase the cost of Lock and Dam No. 2 from \$598,235 to \$733,000.

The district engineer submitted, November 22, 1901, a revised estimate for Locks and Dams Nos. 1 and 2, in which he estimated the cost for both locks and dams at \$1,466,000, or \$299,543 in excess of the limit of cost fixed in the river and harbor act approved March 3, 1899. The estimate is published in House Document No. 164, Fifty-seventh Congress, first session, and in the Report of the Chief of Engineers for 1902, Part II, pages 1664, 1665. The excess is due to the rise in the price of material and labor since the original estimate, to unex-

pected difficulties encountered in the prosecution of the work, and to improvement in the type of work proposed.

The river and harbor act approved June 13, 1902, authorized and directed the Secretary of War to continue the work of improving the Mississippi River between St. Paul and Minneapolis, provided that the expenditure shall not exceed the present limit of cost until further estimate shall have been submitted and the present limit of cost extended by law. The sundry civil act approved March 3, 1903, appropriated \$223,579.33, which is the balance of cost under the original estimate of \$1,166,457. The limit of cost has not yet been extended by law.

The amount expended to June 30, 1903, was \$602,133.99.

During the past year work on Lock and Dam No. 2 was confined to the west 273 feet of the dam. The concrete work in this section was practically completed, and the erection of the two bear-trap sluice gates carried on as far as the receipt of steel work permitted. The contractors for steel work being over a year behind time, the erection of the gates has been correspondingly delayed.

Congress having authorized the prosecution of work on Lock and Dam No. 1 within the limits of the present appropriation, operations were resumed. Plans are now in course of preparation and preliminary work at the site has been commenced.

All lands and flowage rights required for Lock and Dam No. 1 have been acquired with the exception of about 13 acres, which has been made the subject of condemnation proceedings.

No effect on the navigable channel can result until both locks and dams are completed. There are no commercial statistics to report, as steamboats can not navigate this section of the river in its present condition.

Reference to past reports.—For original project for slack-water navigation, by Major Warren, see Annual Reports of the Chief of Engineers for 1867, page 259; 1874, page 287; 1881, page 1747. For surveys and estimates for locks and dams, by Major Allen, see Annual Report of the Chief of Engineers for 1888, page 1563. For removal of bowlders, Annual Report of the Chief of Engineers for 1891, page 2148. Revival of recommendation for slack-water navigation, Annual Report of the Chief of Engineers for 1892, page 1781. Surveys for lock at Meekers Island ordered, Annual Report of the Chief of Engineers for 1893, page 2202. Project and original estimate, Annual Report of the Chief of Engineers for 1894, page 1682. Résumé of plans and estimates for Lock and Dam No. 2, Annual Report of the Chief of Engineers for 1901, page 2298.

July 1, 1902, balance unexpended	\$440, 216. 89
Amount appropriated by sundry civil act approved March 3, 1903	223, 579. 33
	<u>663, 796. 22</u>
June 30, 1903, amount expended during fiscal year	99, 473. 21
July 1, 1903, balance unexpended	564, 323. 01
July 1, 1903, outstanding liabilities	14, 114. 55
July 1, 1903, balance available	<u>550, 208. 46</u>
July 1, 1903, amount covered by uncompleted contracts	14, 957. 00
Amount (estimated) required for completion of existing project	(^a)

(See Appendix B B 1.)

^a The project is not completed, but Congress has not yet adopted the estimate submitted of the additional amount required to do the work.

2. *Reservoirs at headwaters of Mississippi River, and Mississippi River between Brainerd and Grand Rapids, Minn.*—The project adopted January, 1880, calls for the construction of 41 reservoirs in Minnesota and Wisconsin.

The object of these reservoirs is to collect surplus water, principally from precipitation of winter, spring, and early summer, to be systematically released so as to benefit navigation on the Mississippi River below the reservoir dams.

Dams have been constructed as follows: At Lake Winnibigoshish, Leech Lake, Pokegama Falls, Pine River, and Sandy Lake.

The total amount expended at the close of the fiscal year ending June 30, 1903, was \$1,201,331.95. These expenditures cover cost of construction of five dams and their operating machinery, the reconstruction of the dam at Lake Winnibigoshish, and at Leech Lake, in which concrete and steel take the place of the original structure; of superintendence and contingencies; of certain awards for damages; of repairs and partial renewals; also of operating the dams up to February 1, 1895.

The expenditure has resulted in benefit during the low-water season to the navigable portions of the Mississippi River from Grand Rapids, Minn., to the confluence of the Mississippi and St. Croix rivers, about 22 miles below St. Paul, and in the incidental mitigation of the effect of floods in the immediate vicinity of the reservoir dams.

Reasons are given in the Annual Report of the Chief of Engineers for 1897, page 1681 et seq., for limiting the system at that time to the reservoirs then actually constructed. The project for the construction of a sixth reservoir at Gull Lake, Minnesota, is still in abeyance, the United States holding a flowage right for this reservation over about 15,000 acres. The project at present is to replace the present timber structures, which are annually becoming more and more decayed, by permanent dams of concrete or masonry; to define by proper surveys the areas which are occupied for flowage or other purposes in the construction and operation of the reservoirs, and to acquire, by purchase, necessary rights not yet obtained over such areas.

For original plans and surveys see Annual Reports of the Chief of Engineers for 1870, page 285; 1875, page 441; 1879, page 1206; 1881, pages 1761 and 2748; 1882, page 1830; 1885, page 1749. Report of Board of 1880, Annual Report of the Chief of Engineers for 1881, page 1763. Modifications, Annual Report of the Chief of Engineers for 1883, page 1472. Effects on low-water stages, Annual Reports of the Chief of Engineers for 1886, page 1503; 1887, page 1669. Board of 1887 disapproved extension to St. Croix, Chippewa, and Wisconsin rivers, Annual Report of the Chief of Engineers for 1887, page 1680. Description of dams, 1881, page 1763; 1883, page 1456; 1887, page 1667; 1901, page 2313. History, 1892, page 1824; 1901, page 2309. For Secretary of War regulations for operating, see page 1830, Report for 1896. Crevasse, Pine River reservoir, page 1844, Report for 1896, and page 1813, Report for 1897. Second cut in natural embankment, Pine River reservoir, page 2184, Report for 1899.

During the year the reconstruction of Leech Lake dam was completed. The demolition of the old dam at Pokegama Falls was completed so far as necessary, and at the close of the year the work was in readiness for the construction of piers, and contracts made for the

necessary material. The old quarters were remodeled and the working plant completed.

The survey of Lake Winnibigoshish reservoir was completed and the reduction of field notes commenced. The survey of Leech Lake reservoir was continued and was almost completed at the close of the year.

An examination of Willow River and vicinity was made to determine feasibility of constructing a reservoir to retain the flood waters of that stream.

The preparation of lists of lands affected by flowage as shown by the completed portions of resurveys was continued at intervals.

July 1, 1902, balance unexpended	\$250, 307. 85
June 30, 1903, amount expended during fiscal year	86, 139. 80

July 1, 1903, balance unexpended	164, 168. 05
July 1, 1903, outstanding liabilities	9, 201. 89

July 1, 1903, balance available	154, 966. 16
---------------------------------------	--------------

July 1, 1903, amount covered by uncompleted contracts	15, 700. 00
---	-------------

(Amount (estimated) required for completion of existing project	205, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	150, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix B B 2.)

3. *Operating and care of reservoirs at headwaters of Mississippi River.*—The river and harbor act of August 18, 1894, made applicable to the reservoirs at headwaters of Mississippi River “so far as concerns their care, preservation, and maintenance,” the provisions of the general appropriation for “operating and care of canals and other works of navigation, indefinite,” contained in section 4 of the river and harbor act of July 5, 1884. The first allotment was made January 25, 1895, and the expenses from February 1, 1895, have been paid from the indefinite appropriation.

Amount expended to June 30, 1903	\$168, 512. 25
Amount expended during the past year	10, 854. 63

Lake Winnibigoshish, Sandy Lake, and Pine River reservoirs were operated during the entire year. Pokegama Falls reservoir was operated until November, when reconstruction of the dam commenced. The reconstruction of Leech Lake dam was completed in November, since which time the reservoir has been in operation. Necessary repairs of a minor nature were made to the telephone lines between Lake Winnibigoshish and Leech Lake dams and between Sandy Lake dam and McGregor, Minn. The road between Lake Winnibigoshish and Leech Lake dams was repaired. The erection of dam tender's quarters at Leech Lake dam was authorized and the work about three-fourths completed.

For capacities of reservoirs, maps of region, and comparison of rainfall and run-off see Annual Report of the Chief of Engineers for 1896, page 1841. For break in Pine River reservoir see Annual Reports of

^a Required for work as contemplated in the river and harbor acts approved March 3, 1899, and June 13, 1902.

the Chief of Engineers for 1896, page 1844, and for 1897, page 2144. For diagram showing how much water has been stored each year in each reservoir see Annual Report of the Chief of Engineers for 1900, Part IV, page 2798.

July 1, 1902, balance unexpended	\$8, 235. 07
Amount allotted July 16, 1902.....	13, 300. 00
	21, 535. 07
June 30, 1903, amount expended during fiscal year	10, 854. 63
July 1, 1903, balance unexpended	10, 680. 44
July 1, 1903, outstanding liabilities	2, 122. 62
July 1, 1903, balance available	8, 557. 82

(See Appendix B B 3.)

4. *St. Croix River, Wisconsin and Minnesota.*—Before the improvement was begun the low-water depth in the channel above Lake St. Croix was but 2 feet on many of the bars. In Lake St. Croix and below the channel over the Hudson and Catfish bars was narrow and tortuous.

The project adopted in 1875, and amended as to cost in 1882 and 1889, contemplates removal of snags, bowlders, bars, etc., and the contraction of the low-water channel from Taylors Falls to the head of Lake St. Croix, and widening and straightening the channel where it is narrow and tortuous in Lake St. Croix, by dredging and contraction works. The improvement of the harbor and water front of Stillwater, Minn., was added by the river and harbor act of June 3, 1896.

The object of the improvement is to furnish an open channel 3 feet deep from Taylors Falls to the confluence with the Mississippi River, 52.3 miles, and better harbor facilities at Stillwater. The last estimate placed the cost at \$136,700.

In a report upon a preliminary examination and survey of the river from Taylors Falls to Stillwater, submitted in 1899, and printed in House Document No. 104, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 2836, a project was recommended for the annual expenditure of \$1,000 "to keep the river in as good order as is needed for the small steamboat traffic which now exists or is likely to exist in the future." This project will require modification.

The amount expended to June 30, 1903, was \$138,272.52.

The maximum draft that could be carried June 30, 1901, at mean low water was 3 feet at and below Stillwater and 2½ feet above Stillwater.

The tonnage passing over the river is approximately 717,500 tons per annum of loose logs, tows of lumber, and log rafts. A few steamboats made several irregular trips with excursionists during the season, but regular trips could not be made owing to the manipulation of Nevers dam, the river being at times too full of running logs, and at others too low for navigation.

Owing to the limited amount of funds available, operations during the year were restricted to a thorough overhauling and repair of the working plant.

July 1, 1902, balance unexpended	\$2,617.69
June 30, 1903, amount expended during fiscal year	2,390.21
July 1, 1903, balance unexpended	227.48
July 1, 1903, outstanding liabilities	42.00
July 1, 1903, balance available	185.48
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	4,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix B B 4.)

5. *Minnesota River, Minnesota.*—For project and history see pages 1725–1727, Annual Report for 1894, and page 2200, Annual Report for 1899. Since 1893 work has been confined to the improvement and maintenance of channel at mouth of river, the present project requiring an annual expenditure of \$500 for dredging only.

The amount expended upon all projects to June 30, 1903, was \$132,484.90, of which sum \$692.08 was expended in 1899–1900 in removing bar at mouth.

The commerce consists of small pleasure launches and occasional excursion steamers.

During the low-water season of 1902 the Fort Snelling Chute was dredged out to a depth of 3 feet at mean low water.

July 1, 1902, balance unexpended	\$306.66
June 30, 1903, amount expended during fiscal year	291.56
July 1, 1903, balance unexpended	15.10

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	3,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix B B 5.)

6. *Red River of the North, Minnesota and North Dakota.*—For physical characteristics see Annual Report of the Chief of Engineers for 1874, page 295; 1875, page 370; 1878, page 730; 1879, page 1192. For plans of improvement see Annual Report of the Chief of Engineers for 1874, page 297; 1879, page 1191; 1881, page 1757; revisions of project see Annual Reports of the Chief of Engineers for 1883, page 1450; 1887, page 1712. For description of large landslide caused by Northern Pacific Railroad embankment see Annual Report of the Chief of Engineers for 1898, page 1831.

When the improvement of this river began the navigation of the reach from Breckenridge to Moorhead (97 miles) was difficult at all stages and impossible at low water. The second reach, from Moorhead to Grand Forks (155 miles), had a ruling depth at low water of 1.5 feet. The third reach, from Grand Forks to the boundary line of the United States (143.5 miles), had a ruling low-water depth of 2 feet. The low-water navigation of Red Lake River was obstructed by bowlders between Thief River Falls and High Landing, a distance of 35 miles, and by a bad bar at its connection with Red Lake.

The object of the improvement is to provide an open channel on the Red River of the North from Breckenridge to the northern boundary line, 395.5 miles, as follows:

1. Breckenridge to Moorhead (97 miles), a channel capable of being navigated during high and medium stages of water.
2. Moorhead to Grand Forks (155 miles), a channel 50 feet wide and 3 feet deep at low water.
3. Grand Forks to the northern boundary line (143.5 miles), a channel 60 feet wide and 4 feet deep at low water.

Also to provide a 3-foot open-channel improvement of the Red Lake River and Red Lake from Thief River Falls to and including Red Lake, a total distance of 135 miles.

The original estimated cost for improvement of Red River of the North was \$364,598.17, increased in 1883 to \$398,598.17. The estimate was revised in 1887, after Congress had substituted an open-channel improvement for lock and dam at Goose Rapids, and placed at \$252,598.37. An increase of the latter estimate was authorized May 8, 1893, to \$310,320. Congress in 1896 added \$5,000 to the estimate of cost by attaching the improvement of Red Lake River to the project. In 1899 \$4,000 of the \$10,000 authorized was allotted to Red Lake River, so that the present estimate of cost is \$319,320 for both rivers from the beginning of operations.

Red Lake River is under improvement as part of the Red River of the North in accordance with the river and harbor act of June 3, 1896. It formed no part of the original project for the Red River of the North, and has never been accurately surveyed. No properly considered project for its improvement is possible without such a survey, and no reliable estimate of the cost of the improvement exists. Beyond clearing the river of bowlders and logs, nothing should be done till an accurate survey and estimate of cost is available.

The total amount expended to June 30, 1903, including work on Red Lake River, was \$309,275.75.

On June 30, 1903, the object had not been attained on the first division of the Red River of the North, which has for some years been closed against all navigation by permanent pile bridges. The object was attained on the third division and on all but 13 miles of the second, but annual dredging will be needed to maintain the depth. On Red Lake River work has been confined to removing snags, bowlders, and other similar obstructions.

Navigation on Red River is at present confined to comparatively short reaches north and south of Grand Forks, and consists mainly in the transportation of wheat to Grand Forks by 2 steamboats (100 and 23 tons, respectively) and 10 barges. The tonnage during the year 1902 was 20,086.

On Red Lake River 3 steamers of from 24 to 50 tons burden were carrying general merchandise and passengers, the total tonnage in 1902 being 500, and 948 passengers. Eighty-two million feet B. M. of logs was run on the river during the year. Five steamboats are run on Red Lake towing logs, the quantity moved being about 82,000,000 feet B. M.

The maximum draft that could be carried June 30, 1902, at mean low water over the shoalest part of the river under improvement was nothing on the first division, 2 feet on the undredged 13 miles of the second division, and 4 feet on the third division of the Red River of the North, and 18 inches on Red Lake River.

The work during the year consisted of dredging in Red River of the North in the vicinity of Grand Forks, N. Dak., and the removal of obstructions from the channel of Red Lake River above Thief River Falls, Minn.

July 1, 1902, balance unexpended	\$10,586.40
June 30, 1903, amount expended during fiscal year	6,862.15
July 1, 1903, balance unexpended	3,724.25
July 1, 1903, outstanding liabilities	1,279.75
July 1, 1903, balance available	2,444.50
Amount (estimated) required for completion of existing project	6,320.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	9,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix B B 6.)

7. *Warroad Harbor and Warroad River, Minnesota.*—The river and harbor act approved March 3, 1899, as amended by the emergency river and harbor act approved June 6, 1900, appropriated \$3,000, or so much thereof as may be necessary, for improving the mouth of Warroad River, Minnesota. Under this appropriation no work was undertaken beyond making surveys, the balance of funds available having been held subject to action by Congress upon a preliminary report, plan, and estimate submitted June 6, 1900, and published in House Document No. 92, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 2356. The estimate was \$45,000 for a dredging plant and two years' expenses of running the dredge. The river and harbor act approved June 13, 1902, appropriates \$45,000 for carrying on the work as indicated. The House Committee on Rivers and Harbors, by resolution, has referred this project to the Board established by section 3 of the river and harbor act of June 13, 1902, for report upon the desirability of continuing the same or any modification thereof.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the mouth of the river was $4\frac{1}{2}$ feet.

The amount expended to June 30, 1903, was \$5,424.78.

The commerce into the river was 600 tons in 1899. The figures for 1900, 1901, and 1902 could not be obtained.

During the year work was commenced on the construction of a self-propelling centrifugal pump dredge.

July 1, 1902, balance unexpended	\$47,403.37
June 30, 1903, amount expended during fiscal year	4,828.15
July 1, 1903, balance unexpended	42,575.22
July 1, 1903, outstanding liabilities	4,995.54
July 1, 1903, balance available	37,579.68
July 1, 1903, amount covered by uncompleted contracts	5,110.88

(See Appendix B B 7.)

8. *Survey of Red Lake and Red Lake River, Minnesota.*—The survey of Red Lake and Red Lake River, Minnesota, with a view to the construction of a dam with locks at the outlet of said lake for the purpose of improving the navigation of the Red River of the North and said

Red Lake River, Minnesota, and estimating the cost of said improvement, is required by the river and harbor act approved March 3, 1899.

A preliminary report was submitted April 27, 1900, transmitted to Congress, and printed in House Document No. 671, Fifty-sixth Congress, first session, and on pages 2828-2830 of the Annual Report of the Chief of Engineers for 1900.

The river and harbor act approved June 13, 1902, provides for the continuation of this survey. Final report thereon will be transmitted to Congress at its next regular session.

The amount expended to June 30, 1903, was \$5,000.

July 1, 1902, balance unexpended.....	\$10.15
June 30, 1903, amount expended during fiscal year.....	10.15

(See Appendix B B 8.)

9. *Survey of Otter Tail Lake and Otter Tail River, Minnesota.*—A survey of Otter Tail Lake and Otter Tail River, Minnesota, with a view to the construction of a dam at the outlet of said lake for the purpose of improving the navigation of the Red River of the North, Minnesota, and estimating the cost of said improvement, is required by the river and harbor act approved March 3, 1899.

A preliminary report was submitted April 27, 1900, transmitted to Congress, and printed in House Document No. 672, Fifty-sixth Congress, first session, and on pages 2830-2833 of the Annual Report of the Chief of Engineers for 1900.

The river and harbor act approved June 13, 1902, provides for the continuation of this survey. Final report thereon will be transmitted to Congress at its next regular session.

Amount expended to June 30, 1903, \$5,000.

July 1, 1902, balance unexpended.....	\$853.34
June 30, 1903, amount expended during fiscal year.....	853.34

(See Appendix B B 9.)

10. *Survey of Big Stone Lake and Lake Traverse, Minnesota and South Dakota.*—A survey of Big Stone Lake and Lake Traverse, Minnesota and South Dakota, with a view to construct reservoirs therein for the improvement of the navigation of the Minnesota River, and an estimate of the cost of such improvements, is required by the river and harbor act approved March 3, 1899.

A preliminary report was submitted April 26, 1900, transmitted to Congress, and printed in House Document No. 675, Fifty-sixth Congress, first session, and on pages 2833-2836 of the Annual Report of the Chief of Engineers for 1900.

The river and harbor act approved June 13, 1902, provides for the continuation of this survey. Final report thereon will be transmitted to Congress at its next regular session.

Amount expended to June 30, 1903, \$2,478.84.

It is proposed to expend the balance of available funds in continuing hydrological observations.

July 1, 1902, balance unexpended.....	\$3,130.69
June 30, 1903, amount expended during fiscal year.....	609.53

July 1, 1903, balance unexpended.....	2,521.16
July 1, 1903, outstanding liabilities.....	412.19

July 1, 1903, balance available.....	2,108.97
--------------------------------------	----------

(See Appendix B B 10.)

11. *Gauging Mississippi River and its tributaries at or near St. Paul, Minn.*—The river and harbor act of August 11, 1888, authorized the gaugings, but none were made until the fall of 1899. Since then gaugings have been made as frequently as the funds available would permit and the conditions justified the expenditure. For location of gauges see map facing page 1832, Report of the Chief of Engineers for 1898.

Tables showing relation of rainfall to run-off in the Mississippi Valley above St. Paul are printed on page 2169, Report of the Chief of Engineers for 1897. The slope of Mississippi River between Minneapolis and St. Paul is shown in the table of gauge readings given on pages 2823 et seq., Report of the Chief of Engineers for 1900.

Amount expended to June 30, 1903.....	\$6, 220. 06
Amount expended during fiscal year ending June 30, 1903	500. 00

During the year the gauges between Lock and Dam No. 2 and the mouth of the Minnesota River were reestablished and read daily when practicable.

August 6, 1902, amount allotted	\$500. 00
June 30, 1903, amount expended during fiscal year	500. 00

(See Appendix B B 11.)

IMPROVEMENT OF THE MISSOURI RIVER, OF OSAGE RIVER, MISSOURI AND KANSAS, AND OF GASCONADE RIVER, MISSOURI.

This district was in the charge of Capt. H. M. Chittenden, Corps of Engineers. Division Engineers, Col. Amos Stickney, Corps of Engineers, to February 13, 1903, and Col. O. H. Ernst, Corps of Engineers, since that date.

1. *Missouri River.*—(a) *General improvement.*—The Missouri River has been navigated by steamboats since 1819; first boat to Council Bluffs, 1819; first to mouth of Yellowstone, 1832; first to head of navigation, 1859. The length of navigable river from Fort Benton to mouth is 2,285.8 miles. Some portions of the river above the Great Falls are also navigable.

No project for the improvement of the river as a whole has been adopted.

Government work on the river in the matter of removal of snags began as early as 1838 and continued thereafter, under annual appropriations (for the most part made jointly for the Ohio, Mississippi, Missouri, and sometimes the Arkansas, rivers) with occasional intermissions, for the next forty years. Prior to 1878 one or two small appropriations had been made for general improvement, but it was with the act of June 18 of the latter year that appropriations began on a large scale.

The work prior to 1884 was carried on under separate districts. From 1884 to 1890 the work on the entire river was under the Missouri River Commission. After 1890 that portion above, and including Sioux City, Iowa, was under a separate district until 1902. Since the discontinuance of the Missouri River Commission the works on the entire river have been consolidated under one district.

The greater part of the work on the portion of the river below Sioux City has been done by the Missouri River Commission, reporting to the Chief of Engineers. The Commission was constituted by

act of Congress of July 5, 1884, and was abolished by the river and harbor act of June 13, 1902.

On the portion of the river above Sioux City the greater part of the work has been done under the immediate charge of officers of the Corps of Engineers, although for a short time that portion of the river was included in the operations of the Missouri River Commission. The effort of the Commission in its work below Sioux City was to accomplish a continuous, progressive control of the river, contracting it where necessary, giving the channel proper direction and securely holding it in place. Work in this direction was done in the vicinity of Kansas City, and on the first reach of the river, which extends from near Jefferson City to the mouth. On 45 miles of this reach a continuous channel of not less than 6 feet in depth at low water was obtained on what was originally one of the worst parts of the river, in the vicinity of the mouth of the Osage. In addition to forming a channel, much new land was formed and much land protected from destruction by the river. The greater part of the funds appropriated for expenditure under the direction of the Commission was not applicable to the comprehensive plan of improvement adopted, but was diverted by the terms of the appropriations to work at separate localities.

A condensed description of the works on the river executed under the supervision of the Missouri River Commission is given in the Commission's last annual report (Annual Report of the Chief of Engineers for 1902, Supplement).

On the upper portion of the river the work originally consisted mainly in improving the shoals and rapids on the so-called "Rocky River," from Fort Benton downstream for 150 miles. In recent years it has been largely limited to channel regulation and bank protection at the following points: Bismarck, N. Dak.; Pierre, Yankton, and Elk-point, S. Dak., and Sioux City, Iowa. Two ice harbors have been established, one at Rockhaven, S. Dak., the other in the mouth of the Big Sioux River, just above Sioux City.

Works of channel regulation have also been built in the Long Pool, or the reach of the river from the crest of the Great Falls to Cascade, and a small amount of open-river work in the steeper stretch from Cascade to Stubbs Ferry.

A condensed description of the work above the Great Falls will be found in the Annual Report of the Chief of Engineers for 1899, pages 385-386, and in later Annual Reports; and of the work on the river between Fort Benton and Sioux City in the Annual Report of the Chief of Engineers for 1902, pages 382-385.

A complete survey of the river has also been made, in part by the Commission and in part by officers in charge of the districts on the upper portions of the river.

In addition to the foregoing work a fleet of snag boats has been in operation clearing the channel of snags and other obstructions on the portion of the river where boats have been running. This work is considered to be directly beneficial to navigation.

The total of the appropriations for the river from the mouth to Sioux City, since the organization of the Commission, is \$7,325,000.

The total of the appropriations for improvement of the upper river beginning with the act of August 14, 1876, is \$1,886,500.

The total expenditures for all purposes have been \$9,480,568.76. The result of these expenditures has been to demonstrate the possibility of regulating the river in such manner as to make it navigable for a channel of commerce; that the cost of such regulation would be very great, and that no permanent good to navigation can be accomplished by appropriations for specific localities not so connected as to form part of the systematically improved reaches. The result of the expenditures at separated localities has been locally beneficial by protecting the banks and in this manner preserving private property from the ravages of the river, but has been of little, if any, benefit to navigation.

During the past year work has been in the main confined to repair work and snagging. The only extensive construction was at St. Joseph, Mo., where 4,137 linear feet of old revetment was repaired and 3,396 linear feet of new revetment constructed.

The river formerly carried an active commerce which has practically been entirely diverted to other channels. There has been little change in the commercial use of the lower river during the past year; but an increase in activity is noted on the upper river. Two boats are newly operating in the vicinity of Sioux City, and a regular trade has been established as far up as the mouth of the Niobrara. In the latter part of May and first part of June of 1903 the lower part of the river, from St. Joseph down, was visited by the worst flood in its history. The Kansas River contributed a large part of the flood, and the damage along the lower course of this stream runs into the millions.

It is expected that reports of examinations of various localities on the river below Sioux City, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress at its next regular session.

(b) *Snagging upper Missouri River.*—In its original condition the so-called "Sandy River" (between Carroll and Sioux City) was greatly obstructed by snags, and to a less extent by loose rocks.

The original project, adopted in 1890, provides for removing the obstructions and the temporary improvement of the worst shoals, at an estimated cost of \$50,000 annually. The work, begun in 1891, has been continued in each subsequent year under allotments and appropriations for this purpose.

The total of the appropriations for this work is \$393,073.53. In the act of June 13, 1902, the appropriation for snagging was consolidated with that for the general improvement of the river.

The expenditures to June 30, 1902, were \$392,624.62. Three snag boats had been constructed or purchased and had been operated as funds permitted.

The river has been kept fairly clear of snags and obstructions over the portions used by commercial boats.

A machine shop has been erected at the Sioux ice harbor and equipped with machinery, principally for use in repairing snag boats.

A new line of two small steamboats plying short distances above and below Bismarck was put on in 1901 by the Bismarck, Washburn and Great Falls Railway Company.

The commercial statistics for this work are incorporated with those for the general improvement of Missouri River.

Amount of freight carried on the Missouri River from mouth to Sioux City, Iowa.

Calendar year.	Tons.	Calendar year.	Tons.
1897	391, 029	1900	277, 306
1898	319, 793	1901	569, 666
1899	263, 114	1902	410, 527

Amount of freight carried on the Missouri River above Sioux City, Iowa.

Calendar year.	Tons.	Calendar year.	Tons.
1887	13, 961	1895	21, 264
1888	12, 895	1896	10, 368
1889	16, 723	1897	17, 105
1890	14, 072	1898	26, 896
1891	14, 211	1899	23, 041
1892	17, 292	1900	27, 179
1893	19, 481	1901	37, 340
1894	37, 936	1902	31, 070

July 1, 1902, balance unexpended.....^a \$282, 315. 04
 Miscellaneous receipts during the year..... 21, 635. 99

June 30, 1903, amount expended during fiscal year 303, 951. 03
 157, 977. 95

July 1, 1903, balance unexpended 145, 973. 08
 July 1, 1903, outstanding liabilities 21, 968. 31

July 1, 1903, balance available 124, 004. 77

{ Amount (estimated) required for completion of existing project Indefinite.
 Amount that can be profitably expended in fiscal year ending June 30, 1905,
 for snagging, in addition to the balance available July 1, 1903 50, 000. 00
 Submitted in compliance with requirements of sundry civil act of June 4,
 1897.

(See Appendix C C 1.)

2. *Osage River, Missouri and Kansas.*—A history of the work of improvement on this river from the adoption of the original project in 1871 to the end of the fiscal year 1900 was published in the Annual Report of the Chief of Engineers for 1900, page 4944.

The work has been carried on under two projects—that of open-channel improvement by the construction of cross and wing dams in addition to dredging and removal of obstructions to navigation, such as snags, etc., and the construction of a lock and dam 7 miles above the mouth of the river.

The removal of obstructions under the first project contemplates only temporary relief. The obstructions are constantly forming anew, and while the cross and wing dams have a degree of permanency, they must receive frequent repair and extension to keep up their efficiency. No definite time, therefore, can be fixed for its completion and no estimate made of its ultimate cost. The improvement must be a continuous one and the annual estimates must depend upon conditions as they arise.

^a Includes \$175,598.53 for lower river, \$106,267.60 for upper river, \$448.91 for snagging.

The amount expended by the General Government upon both projects up to June 30, 1903, is \$365,526.23; amount expended during the past fiscal year is \$18,417.99.

For reasons stated in detail in the report of the district officer it will be necessary to make a large additional appropriation if the lock and dam are to be completed. The great delay in their completion, arising from the failure of the river and harbor bill in 1901, and the heavy damage caused by the great flood of last spring, have entirely altered the situation from what it was when the estimate for completing the lock (November 1, 1900) was submitted. It is urgently recommended that this amount be appropriated at once in order that work may be finished during the season of 1904. In its present condition it is the most formidable obstruction to navigation on the entire navigable course of the river. The cost of completion is estimated at \$70,000.

Amount of freight carried on the Osage River.

Calendar year.	Tons.	Calendar year.	Tons.
1895.....	76,706	1899.....	76,702
1896.....	72,393	1900.....	96,144
1897.....	71,247	1901.....	72,339
1898.....	84,286	1902.....	95,194

July 1, 1902, balance unexpended	\$35,924.07
June 30, 1903 amount expended during fiscal year	18,417.99

July 1, 1903, balance unexpended	17,506.08
July 1, 1903, outstanding liabilities	245.22

July 1, 1903, balance available	17,260.86
---------------------------------------	-----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	70,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix C C 2.)

3. *Gasconade River, Missouri.*—The project for the improvement of this stream, adopted in 1880, consisted in the removal of snags and logs from the channel and of leaning timbers from the banks of the river where necessary, and the construction of wing dams and training walls to concentrate the flow of water upon the shoals to increase the depth over them.

From the nature of the project, which contemplates only temporary relief from year to year and the removal of obstructions which are constantly forming anew, no definite time can be fixed for its completion and no estimate made of its ultimate cost. The improvement must be continuous, and the annual estimates must depend upon conditions as they arise.

The original estimated cost of the project was \$50,000, and the principal work contemplated by it has been accomplished, but for reasons just stated the work can never be considered completed.

During the past season the boating channel was cleared of snags and wreck heaps and all overhanging trees were trimmed or felled.

The amount expended under the project to June 30, 1903, is \$79,072.40, of which sum \$3,831.94 was expended for maintenance of improvement.

Amount of freight carried on the Gasconade River.

Calendar year.	Tons.	Calendar year.	Tons.
1895	47,544	1899	24,259
1896	46,291	1900	51,540
1897	30,515	1901	19,460
1898	30,981	1902	44,380
July 1, 1902, balance unexpended			\$10,259.54
June 30, 1903, amount expended during fiscal year			3,831.94
July 1, 1903, balance unexpended			6,427.60
July 1, 1903, outstanding liabilities			1.54
July 1, 1903, balance available			6,426.06
{ Amount (estimated) required for completion of existing project			Indefinite.
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.			20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.			

(See Appendix C C 3.)

IMPROVEMENT OF CUMBERLAND RIVER, TENNESSEE AND KENTUCKY, AND OF OBION AND FORKED DEER RIVERS, TENNESSEE.

This district was in the charge of Lieut. Col. M. B. Adams, Corps of Engineers, to April 22, 1903, and in the charge of Capt. W. J. Barden, Corps of Engineers, since that date. Division Engineer, Col. G. J. Lydecker, Corps of Engineers, since April 22, 1903.

1. *Obion and Forked Deer rivers, Tennessee.*—(a) *Obion River.*—This stream is situated in northwestern Tennessee, taking its rise in Henry and Weakley counties. It has a north and south fork that unite about 85 miles above its mouth in the Mississippi River, some 5 miles below the Missouri and Arkansas State line. The head of navigation is regarded as at Obion, Tenn., where it is crossed by the Illinois Central Railroad.

In its original condition the obstructions on this river were almost wholly drift, snags, and overhanging trees, which made navigation difficult and uncertain.

An examination of this stream was made in 1880. (Report of the Chief of Engineers, 1881, pp. 1486-1489.)

The original project was based on a survey made in 1891 (Annual Report of the Chief of Engineers for 1891, p. 2292 et seq.) and was adopted by the river and harbor act of July 13, 1892. The scope of the work was to obtain 3-foot navigation at low water by means of open-channel work, at an estimated cost of \$50,000. As it was unlikely that the result aimed at could be achieved by this method, and as it was thought that the reasonable and proper method of improvement would be simply to keep the river free from such obstructions as would prevent navigation at medium and high stages, at an esti-

mated annual cost of \$2,500, the above project was modified accordingly, and as modified is still in force. This modified or present project was adopted June 1, 1897.

For this separate section appropriations and allotments aggregating \$26,000 have been made, of which \$23,524.32 has been expended to June 30, 1903, \$7,729.31 being applied to maintenance of channel.

The expenditures have resulted in securing an improved channel from Obion, Tenn., to mouth of river. In 1893 a small steamboat with tow was enabled to ascend the river, the first in fifty years.

The navigability of the Obion River depends largely on the stage of water in the Mississippi.

The commerce of this stream consists principally of lumber.

(b) *Forked Deer River*.—This stream carries off most of the rainfall of Carroll, Gibson, Henderson, Madison, Chester, and Crockett counties, Tenn., and empties into the Obion River 3½ miles above its mouth.

In its original condition the main stream and its branches, the North Fork and South Fork, were greatly obstructed by snags, drift, etc. The original project for this section may be said to have been adopted by the river and harbor act of August 2, 1882, and was based on a report of an examination of South Fork, dated December 16, 1880. (Annual Report of the Chief of Engineers for 1881, p. 1489 et seq.) This project was subsequently modified by extension to include the North Fork and main stream until appropriations aggregating \$25,000 were made and expended. The operations proposed were open-channel work, by which it was sought to maintain a satisfactory channel all the year round. This project was set aside in view of the fact that the result aimed at could not be accomplished by said method.

The present project, adopted July 24, 1896, based on the provisions of the act of June 3, 1896, may be said to have been modified by approval of March 27, 1899, based on act of March 3, 1899, and provides for the removal of surface obstructions by open-channel work from the improved channels of the Forked Deer River and its navigable branches (North and South forks), at an estimated annual cost of \$2,000. (See Annual Report of the Chief of Engineers for 1898, p. 1873.)

Under this project appropriations and allotments for this section have been made aggregating \$10,000, of which \$8,024.31 has been expended to June 30, 1903, \$3,024.31 being applied to maintenance of channel.

The expenditures have been productive of an improved channel so that small boats drawing not more than 2½ feet can now navigate with greater ease and safety about eight months of the year. The navigability of the Forked Deer River depends largely on the stage of water in the Mississippi. The head of navigation is Dyersburg, Tenn.

The river and harbor act of June 13, 1902, authorized the conjunctive improvement of the Obion and Forked Deer rivers. (Report Chief of Engineers, 1899, p. 395.) No operations were carried on during the fiscal year. Expenditures were on account of watching and caring for plant.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

During the calendar year ending December 31, 1902, the commerce on these streams amounted to 117,415 tons, having an estimated value of \$611,303. Passengers carried, 1,370.

Comparative statement of traffic for five years for Obion and Forked Deer rivers.

Calendar year—	Tons.
1898.....	116,525
1899.....	118,622
1900.....	214,907
1901.....	26,717
1902.....	117,415
July 1, 1902, balance unexpended	\$4,712.70
June 30, 1903, amount expended during fiscal year	261.33
July 1, 1903, balance unexpended	4,451.37
July 1, 1903, outstanding liabilities	24.50
July 1, 1903, balance available	4,426.87
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903 4,500.00 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix D D 1.)	

2. *Cumberland River, Tennessee and Kentucky.*—The Cumberland River rises in eastern Kentucky, on the western slope of the Cumberland Mountains; flows in a tortuous course of about 688 miles through eastern Kentucky, middle Tennessee, and western Kentucky, and discharges into the Ohio River near Smithland, Ky. From Point Burnside, Ky., the head of steamboat navigation, to Smithland, Ky., the distance is 518 miles by the river, 203 miles being in the State of Kentucky and 315 miles in the State of Tennessee.

(a) *Below Nashville (191 miles).*—From 1830 to 1840 the legislatures of Tennessee and Kentucky made several appropriations for the improvement of the navigation of the Cumberland River, but little benefit to the general condition of the river seems to have been accomplished. The Cumberland Navigation Company was incorporated by the State of Tennessee in 1846, for improving the "navigation of the Cumberland River below the town of Nashville by means of a system of locks and dams," but nothing tangible was done to carry out the proposed improvement.

In its original condition this section of the river was considerably obstructed by rocky ledges; conglomerate, gravel, and sand bars; snags, and other surface obstructions, on account of which navigation was rendered very uncertain.

From July 17, 1832, to July 7, 1838, Congress made five appropriations for improving the Cumberland River, Tennessee and Kentucky, aggregating \$155,000, \$20,000 of which was to be expended below Nashville and \$135,000 on the river generally, but the records show that all the appropriations for the above period were expended below Nashville.

Between 1838 and 1871 no appropriations for this river were made. The original project (open-channel work) which provided specifically

for operations on this section, was adopted by the river and harbor act of March 3, 1871, based on project submitted January 20, 1871. (See Annual Report of the Chief of Engineers for 1871, p. 468. See also *id.*, 1872, p. 462; 1884, p. 1646; 1887, p. 1759.) The work proposed was as follows: To excavate the bars and rock ledges to get an additional depth of water, to contract the waterways in places to get the requisite depth, to remove snags and bowlders from the main channel, and to restrain tributary streams in well-determined channels at their junction with the river.

To increase the depth of water at the shoals at the junction of the Cumberland River with the Ohio River, a Board of Engineer officers recommended the construction of a dike near Smithland, Ky., at an estimated cost of \$129,600. (Annual Report of the Chief of Engineers for 1888, pp. 1626-1632.) The river and harbor act of September 19, 1890, allotted \$30,000 from the appropriation for improving Cumberland River below Nashville, to be expended in improving the mouth of the river, as recommended.

Appropriations aggregating \$305,000 were made and expended under the above project. The expenditures under the old project have resulted in lengthening the season of navigation by giving an increased depth at low water combined with greater security in the passage of obstructions. (Annual Report of the Chief of Engineers for 1896, p. 1907.)

The present project for improving the Cumberland River below Nashville was adopted July 13, 1892, by river and harbor act of that date. It contemplates the extension of the lock and dam system of the upper river over a considerable portion of the river below Nashville by the construction of 7 locks and dams, commencing at or near Harpeth shoal (Lock A) and ending at Big Eddy shoal (Lock G); the locks to be 52 feet wide and 280 feet long, with lifts varying from 8½ to 11½ feet, and aggregating some 70 feet. The project also includes the improvement of the Kentucky chute at the mouth of the river according to the recommendation of the Board of Engineer officers, June 16, 1888 (Annual Report of the Chief of Engineers for 1888, p. 1628), the necessary channel work below Lock G, and the removal of surface obstructions, snags, logs, etc., below Nashville. The total estimated cost of the entire improvement is \$1,964,500. (Annual Report of the Chief of Engineers for 1890, pp. 2151-2161.)

Inasmuch as the shoals near the mouth of Harpeth River constitute the most formidable obstruction of the Cumberland below Nashville, it is proposed to press the work on Lock A and its accessories to completion at the earliest possible date. Appropriations aggregating \$430,000 have been made for this work under the new or canalized river project.

The expenditures to June 30, 1903, under this project amounted to \$281,546.71, of which \$14,220.67 was for maintenance.

At Lock A the masonry of the lock, the paving and riprapping on the lock side of the river, and the masonry of the abutment is practically completed. Most of the stone required for filling for the dam and for riprapping and paving on the abutment side is on hand.

During the fiscal year the work consisted in building a masonry retaining wall, filling in and paving behind the land wall of the lock, riprapping the slopes, removing cofferdam, extending the abutment,

and quarrying and breaking stone for the dam. Contracts were let for dredge and floating plant to be used both above and below Nashville. Plans were prepared for the gates, operating machinery, and valves for Lock A and for Lock No. 1 of the system above Nashville, and the work twice advertised. The only bid received was rejected as being excessive. New designs are being prepared and the work will shortly be readvertised. Timber gates will be built if no reasonable bids are received for steel gates. The river was cleared of snags during the fall of 1902.

With the exception of maintaining the channel of the river as improved by the open-channel work of the previous project, the expenditure under the present project has not yet benefited navigation by any increased depth, and can not do so until Lock A is completed and operated. The cost of maintenance of the river in its present condition is estimated at \$5,000 per annum.

The Cumberland River below Nashville is usually navigable for all steamboats plying on it for six months in each year; for boats not drawing over 3 feet, from six to eight months, and for boats drawing 16 inches or less, the whole year. Navigation is practically closed for several months each year during low water. As a general rule, when the stage is below $2\frac{1}{2}$ feet navigation is closed; between $2\frac{1}{2}$ and 5 feet it is uncertain, and above 5 feet good. A table was given on page 389 of the Annual Report of the Chief of Engineers for 1902 showing the variations of level of water surface on this river.

The tonnage for the calendar year 1902 was reported as 283,531 tons, valued at \$7,347,047. Passengers carried, 25,000.

Comparative statement of traffic for five years.

Calendar year—	Tons.
1898.....	120, 232
1899.....	263, 608
1900.....	407, 088
1901.....	255, 557
1902.....	283, 531
July 1, 1902, balance unexpended.....	\$180, 455. 17
Proceeds sale of land, Lock A.....	800. 00
	181, 255. 17
June 30, 1903, amount expended during fiscal year.....	31, 839. 93
July 1, 1903, balance unexpended.....	149, 415. 24
July 1, 1903, outstanding liabilities.....	24, 395. 88
July 1, 1903, balance available.....	125, 019. 36
July 1, 1903, amount covered by uncompleted contracts.....	23, 459. 00
{ Amount (estimated) required for completion of existing project.....	1, 534, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1906, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	200, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(b) *Above Nashville (357 miles).*—In its original condition this section of the river was considerably obstructed by rock reefs, ledges, snags, etc., which greatly impeded navigation.

The original scheme of improvement for this section, as modified and extended, contemplated open-channel work from Nashville, Tenn.,

to Cumberland Ford (Pineville, Ky.), 497 miles, at an estimated cost of \$374,764, and was based on projects submitted January 20, 1871, and February 8, 1872. (See Annual Reports of the Chief of Engineers for 1871, page 468 et seq.; 1872, page 463 et seq.; also *id.*, 1875, page 796; 1877, page 594; 1879, page 1267; 1881, page 1859.)

The first appropriation specifically applicable to the Cumberland River above Nashville was made by the act of August 14, 1876.

This open-channel scheme of improvement or old project resulted in giving increased depths at several of the principal obstructions, thus securing a longer and safer period of navigation. Under this project and its modifications appropriations aggregating \$346,000 were made and expended.

The existing project for the canalization of the Cumberland River above Nashville is based on reports of an examination and survey in 1882 and 1883 (Annual Report of the Chief of Engineers for 1884, p. 1662 et seq.) and on the acts of September 19, 1890, and July 13, 1892; it was adopted August 5, 1886, by river and harbor act of that date. The project was modified by the adoption of larger locks than were first recommended and the estimate revised (Annual Report of the Chief of Engineers for 1891, p. 2270).

By act of September 19, 1890, Congress provided that of the general appropriation for improving Cumberland River above Nashville, \$50,000 might be expended in commencing the improvement at Smith shoals, and by acts of July 13, 1892, and August 18, 1894, it was provided that \$10,000 of a like general appropriation might be used "in the improvement of the river above the town of Burnside."

This scheme of improvement proposes the construction of 23 locks and dams below Burnside and 6 locks and dams at Smith shoals, above Burnside; and it intends to provide a complete system of lockage from Nashville, Tenn., to Rock Castle River, so as to afford a channel depth of 6 feet, the locks to be 52 feet wide and 280 feet long, with lifts varying from 10 to 12 feet, at an estimated cost of \$8,500,000. (See Annual Report of the Chief of Engineers for 1896, p. 1916.) Of this amount, \$1,895,000 has been appropriated.

The amount expended to June 30, 1903, under the present project is \$1,651,758.78, of which sum \$20,252.94 was expended on the Smith shoals section in making the necessary examinations and surveys for the 6 locks and abutments of dams of that series, and in obtaining abstracts of title to all the sites and for contingencies, and \$5,871.60 was expended in acquiring sites for locks and abutments of Dams Nos. 21 and 22, and contingencies. But no work of construction has been done either at Smith shoals or at Locks 21 and 22.

The condition of the work is as follows:

Locks Nos. 1, 5, 6, and 7 (2.5 miles below, and 72 miles, 89.6 miles, and 106.6 miles, respectively, above Nashville).—The masonry of the lock walls and abutments of the dams is completed.

Locks Nos. 2, 3, and 4 (9 miles, 26 miles, and 44.75 miles, respectively, above Nashville).—The masonry of the locks is completed. Lock No. 2 will require no abutment for the dam; the abutments of dams at Nos. 3 and 4 are under construction.

Lock No. 8 (125.25 miles above Nashville).—Sites for the lock and abutment have been approved and the abutment site acquired.

Locks Nos. 9 to 20.—No surveys have been made to determine and select sites for these locks.

Locks Nos. 21 and 22 (296.25 miles and 320.25 miles, respectively, above Nashville).—By act of June 3, 1896, \$20,000 was made specifically applicable to these locks, and sites for the locks and abutments have been acquired. There is a balance of \$16,875.39 applicable to these locks which can not be advantageously used, unless sufficient appropriations to complete one lock and dam are made.

Smith shoals section—Locks Nos. 1 to 6.—The sites of these locks and abutments for the dams have been approved, and authority granted to obtain the land by voluntary purchase, if practicable; otherwise by condemnation. Abstracts of title to all the sites have been procured, the records being brought up to April 18, 1898. The allotments for this section amount to \$30,000, of which there remains a balance of \$9,747.06.

For a statement of the work done during the fiscal year at Locks 1, 2, 3, 4, and 5, and snagging, see Appendix D D 2 of this report. A statement of contracts let for floating plant and steps taken for the construction of the gates at Lock No. 1 is given under the heading, "Cumberland River below Nashville."

The availability or adaptability of the improvement for the purposes of navigation and commerce has not been increased by the work done under the existing project, and can not be until a definite section of the river has been canalized and locks put in operation. The present condition of the work by reason of its character and incompleteness is such that it has not at present any appreciable effect upon the object sought to be attained—that is, the opening up of the upper Cumberland River to navigation—other than that the improved channel already secured has been maintained.

The cost of maintenance of the river in its present condition, as improved by open-channel work of past years, is estimated to be about \$5,000 per annum.

The Cumberland River is navigable usually from Nashville to Point Burnside, Ky., 325 miles, for steamboats drawing not more than 3 feet, from four to six months of each year, and for boats of greater draft from two to three months. The fall is 223 feet, or about 8 inches per mile.

From Nashville to Caney Fork River (Carthage, 116 miles) the river is navigable for steamboats of 2½ feet draft from six to eight months, and for those of greater draft four or five months. Steamboats of light draft can ascend to Burkesville, 236 miles above Nashville, for from five to seven months, and larger boats four or five months. The head of navigation is Burnside, Ky.

The commerce of the Cumberland River above Nashville for the calendar year 1902, as nearly as could be ascertained, aggregated 192,270 tons, having an estimated value of \$5,527,886. Passengers carried, 29,265.

Comparative statement of traffic for five years.

Calendar year—	Tons.
1898.....	124, 518
1899.....	294, 763
1900.....	289, 218
1901.....	267, 211
1902.....	192, 270

July 1, 1902, balance unexpended	\$270, 689. 83
June 30, 1903, amount expended during fiscal year	26, 998. 44
July 1, 1903, balance unexpended	243, 691. 39
July 1, 1903, outstanding liabilities	26, 926. 39
July 1, 1903, balance available	216, 765. 00
July 1, 1903, amount covered by uncompleted contracts	23, 459. 00
(Amount (estimated) required for completion of existing project.	6, 605, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	300, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix D D 2.)	

3. *Removing sunken vessels or craft obstructing or endangering navigation.*—The wreck of steamer *W. K. Phillips* was removed by the United States from Dover Island Chute, Cumberland River, at a cost of \$335.20. Final report submitted to the Chief of Engineers, November 13, 1902.

(See Appendix D D 3.)

IMPROVEMENT OF TENNESSEE RIVER AND ITS TRIBUTARIES.

This district was in the charge of Maj. John G. D. Knight, Corps of Engineers, to April 25, 1903, and in the charge of Capt. W. J. Barden, Corps of Engineers, since that date. Division Engineer, Col. G. J. Lydecker, Corps of Engineers.

TENNESSEE RIVER SYSTEM.

The Tennessee River is 651 miles long, and, with its principal tributaries, forms a system of internal waterways capable of being navigated more than 1,350 miles by steamboats. In addition to this, it is still further navigable by rafts and flatboats for a distance of more than 1,000 miles, thus making a system of navigable waters 2,350 miles in length.

1. *Tennessee River.*—The improvement has been carried on in three sections, under separate appropriations.

(a) *Above Chattanooga, Tenn. (188 miles).*—In its original condition this part of the river was obstructed by rock reefs, bowlders, gravel bars, and snags. The depth of water on the bars varied from 10 to 30 inches at low water, and in some places the current was as great as 6 miles an hour.

The present project is to obtain, by training walls, wing dams, and dredging, a low-water channel 3 feet deep from Chattanooga to the mouth of the French Broad River. The estimated cost is \$650,000. A small part of the appropriation of June 13, 1902, is reserved for necessary work at Richland Creek. Up to June 30, 1895, the sum of \$328,255.83 had been expended under a previous project. The total amount expended under the present project up to June 30, 1903, was \$128,303.58.

As a result, the river may be used by boats drawing 2 feet, except during periods of very low water, which usually occur in summer and autumn. The river is navigable to its head.

The total value of freight carried on this portion of the river during the calendar year ending December 31, 1902, was \$4,296,822.

A record of the examinations, surveys, and reports of this section of the river is found in the Annual Report of the Chief of Engineers for 1900, pages 2908-2909.

July 1, 1902, balance unexpended	\$50,030.02
June 30, 1903, amount expended during fiscal year	30,589.43
July 1, 1903, balance unexpended	19,440.59
July 1, 1903, outstanding liabilities	1,528.73
July 1, 1903, balance available	17,911.86
(Amount (estimated) required for completion of existing project.....	505,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	50,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(b) *Chattanooga, Tenn., to Riverton, Ala. (237.3 miles).*—In its original condition the channel from Chattanooga to Browns Ferry was obstructed by bars, bowlders, reefs, and rocky projections. Navigation was possible during six to nine months annually. Between Browns Ferry and Florence were the Big and Little Muscle shoals, which could be crossed at unusually high water only. Between Florence and Riverton the Colbert and Bee Tree shoals prevented navigation for six months of the year.

The present project proposes to remove obstructions by blasting and dredging at Ross towhead, Bridgeport, Guntersville, and elsewhere; to build a canal 14.5 miles long, 70 to 120 feet wide, and 6 feet deep, past Big Muscle shoals; a canal 1½ miles long at Elk River shoals; a canal 3 miles long at Little Muscle shoals, and a canal 8 miles long past Colbert and Bee Tree shoals.

The total amount expended to June 30, 1903, was \$4,562,773.65.

This expenditure has resulted in the completion of the Big Muscle shoals and Elk River canals and their approaches at a cost of \$3,181,726.50, and in the improvement of Little Muscle shoals under a former project by excavation and the construction of wing dams, whereby its navigation was greatly improved; but as the results showed that the requisite depth could not be obtained in this manner, the present project for a lateral canal was adopted October 29, 1890.

In like manner the Colbert and Bee Tree shoals were temporarily improved at a cost of \$62,243.41 before the adoption of the present project for a lateral canal, on which \$739,636.85 additional has been expended.

The masonry of the lift lock at Colbert shoals has been completed, the right of way for the canal purchased and paid for, and a contract let, May 5, 1903, for so much of the canal section above the guard lock as can be built with the funds available, about \$545,000, and \$50,000 to be appropriated later. Up to June 30 the contractor had assembled his plant, erected temporary buildings, and was hauling logs and sawing lumber for the cofferdam.

At several localities the channel depth at low water is less than 3 feet, and at four localities it ranges from 1 to 1.8 feet.

For details of the river from Chattanooga to Lock A, Muscle Shoals Canal, see House Document No. 50, Fifty-seventh Congress, first session, and Annual Report of the Chief of Engineers for 1902, page 1743; and House Document No. 461, Fifty-sixth Congress, first session, and Annual Report of the Chief of Engineers for 1900, page 2596.

July 1, 1902, balance unexpended	\$211,544.47
Amount appropriated by sundry civil act approved March 3, 1903	350,000.00
Amount allotted from appropriation for emergencies in river and harbor works	6,000.00
June 30, 1903, amount expended during fiscal year	567,544.47
	15,169.21
July 1, 1903, balance unexpended	552,375.26
July 1, 1903, outstanding liabilities	6,592.50
July 1, 1903, balance available	545,782.76
July 1, 1903, amount covered by uncompleted contracts	500,000.00
(Amount (estimated) required for completion of existing project	5,165,326.63
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	a 550,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(c) *Below Riverton, Ala. (226 miles).*—This part of the river is below most of the large tributaries. It has therefore more water than the upper river; and as the width is not too great and the slope uniform and moderate, it is accessible to larger boats. The ruling depths are $3\frac{1}{2}$ feet over the lower 196 miles, and 2 feet above this.

The existing project is to obtain, by dredging, a channel not less than 5 feet deep and 150 feet wide, and to protect Livingston Point and Tennessee Island from erosion, with a view to preserving the port of Paducah, Ky.

The total amount expended to June 30, 1903, was \$286,081.54. The work at Livingston Point and Tennessee Island is completed, and the worst obstructions have been removed from the channel.

July 1, 1902, balance unexpended	\$19,000.00
June 30, 1903, amount expended during fiscal year	11,081.54
July 1, 1903, balance unexpended	7,918.46
July 1, 1903, outstanding liabilities	1,596.31
July 1, 1903, balance available	6,322.15

(Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E E 1.)

2. *Operating and care of Muscle Shoals Canal, Tennessee River.*—For some details of this canal and its operation and care, also the

a Of this amount, \$50,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

dimensions of locks, aqueduct, and drift sluice, see pages 2440-2446, Annual Report of the Chief of Engineers for 1901, and page 1729 of Report for 1902.

The canal is 16 miles in length and has 11 locks. A railroad nearly 15 miles in length is operated in connection with the maintenance of the canal.

Fifteen streams empty into the canal, none of them very large. Bars are constantly forming opposite their mouths and also at the entrances to the canal. A Bucyrus dredge is kept on the canal in order to remove these bars as fast as they form. A special allotment of \$8,000 was made during the year to rebuild this dredge. The work is well along toward completion.

The repairs made necessary by the storm of March 28, 1902, were completed during the year.

A special allotment of \$1,200 was made for the purchase of a tract of land adjacent to the canal as a compromise of a suit against the United States for possession and damages. The amount paid for the land was \$1,000, and the cost of recording the deed was \$1.

The number of commercial steamboats and barges that used the canal during the calendar year ending December 31, 1902, was 335, and the freight carried was 7,712 tons, valued at \$577,505. The number of lockages was 1,987. The total amount expended during the fiscal year ending June 30, 1903, was \$85,186.52, of which \$12,950.16 was from the special allotment of \$30,000 for repairing the damage done by the storm of March 28, 1902; \$5,576.20 was from the special allotment of \$8,000 for rebuilding the dredge *Bucyrus*, and \$1,004 was from the special allotment of \$1,200 for the purchase of land.

(See Appendix E E 2.)

3. *French Broad and Little Pigeon rivers, Tennessee.*—(a) *French Broad River.*—This river is one of the largest tributaries of the Tennessee. It rises in North Carolina, flows generally in a westerly direction, and finally unites with the Holston River in the State of Tennessee, to form the Tennessee River.

In its original condition the river was obstructed by rock reefs, sand and gravel bars, and by bowlders, snags, and overhanging trees, and numerous islands in the river divided the water and diminished the depth in the navigable channels.

The project for its improvement is based upon a reconnaissance made about thirty years ago. It has for its object the removal of surface obstructions, the excavation of channels through reefs and bars, and the concentration and regulation of its flow by means of wing dams and training walls, so as to secure a channel depth of 2½ feet at ordinary low water as far up as the town of Leadvale, a short distance below the mouth of the Nolichucky.

The amount expended to June 30, 1903, was \$86,555.20. This expenditure resulted in the improvement of navigation below Dandridge, 50 miles from the mouth, by deepening and clearing the channel, removing natural and artificial obstructions, constructing wing dams, sills, and training walls, and revetting the banks where necessary.

The head of navigation is Leadvale, at the mouth of the Nolichucky River, 70 miles above the mouth of the French Broad.

The total value of the freight carried on the French Broad River during the calendar year 1902 was reported to be \$1,810,772.

A report of a survey of the French Broad River made in 1899 is published in House Document No. 616, Fifty-sixth Congress, first session, and in the Annual Report of the Chief of Engineers for 1900, page 3018.

(b) *Little Pigeon River*.—This river is formed by the junction of its east fork and south fork at Sevierville, Tenn., and flows in a northwesterly direction for about 5 miles, where it empties into the French Broad about 32 miles above Knoxville.

In its original condition it was obstructed by rock and gravel shoals and by rapids.

The project provides for the removal of the bar near the mouth of the river, and the removal of the shoal below Catlettsburg so as to permit light-draft steamers to reach that place.

A channel 30 inches deep at low water has been dredged through the bar at the mouth of the Little Pigeon; the head of McCroskeys Island has been riprapped, and the dam across the island chute repaired.

It is impracticable to separate the freight carried on the Little Pigeon River from that carried on the French Broad, as the same boats are engaged in the trade, and the navigable part of the Little Pigeon, being about 2 miles long, practically amounts to an additional landing on the French Broad.

Owing to the great slope of the Little Pigeon River, it is subject to sudden and violent freshets, and these bring down coarse gravel and boulders, which tend to re-form the two bars which now obstruct the navigable portion of it. Redredging of these bars will be necessary from time to time, and the improvement can never be considered as completed.

The river and harbor act of July 13, 1892, provided that of the \$15,000 appropriated for improving French Broad River, Tennessee, \$1,000 "may be used in removing bar or shoal in Little Pigeon River." This is the only separate appropriation ever made for this river.

July 1, 1902, balance unexpended.....	\$16,402.61
June 30, 1903, amount expended during fiscal year	7,957.81
July 1, 1903, balance unexpended.....	8,444.80
July 1, 1903, outstanding liabilities.....	833.74
July 1, 1903, balance available	7,611.06
Amount (estimated) required for completion of existing project	65,000.00
(See Appendix E E 3.)	

4. *Clinch, Hivasssee, and Holston rivers, Virginia and Tennessee.*—

(a) *Clinch River*.—This river rises in the Cumberland Mountains in Virginia, and after following a southwesterly course empties into the Tennessee River at Kingston, 104 miles above Chattanooga. About 230 miles of the river lies in the State of Tennessee.

In its original condition the channel was obstructed by rock reefs, sand and gravel bars, boulders, snags, and overhanging trees.

The present project provides for channel excavations, removing surface obstructions, and the construction of wing dams and training walls, so as to secure a navigable channel 2 feet in depth at ordinary low water from the mouth of the river to Clinton, about 70 miles, and of 1½ feet in depth from Clinton to Haynes (or Walkers) Ferry, about

75 miles. From Haynes Ferry to Osborne Ford, in Virginia, a distance of 120 miles, it is proposed simply to remove the loose rock and bowlders, reduce the rock ledges, and remove snags, overhanging trees, and similar obstructions, so as to assist raft and flatboat navigation at the stages at which the river is ordinarily used.

The amount expended to June 30, 1903, was \$52,071.13, which had resulted in reducing many of the reefs, removing obstructions from the channel, and building several wing dams and training walls, whereby the channel was so far improved that the river could be used at stages 2 to 3 feet lower than before the improvement was begun.

Small steamboats navigate the Clinch River as far as Clinton.

The total commerce on the Clinch River for 1902 was 129,925 tons, valued at \$2,272,348, of which 50 per cent was transported only from Kingston to the mouth, a distance of less than 1 mile. Of the remainder, 64,805 tons was floated down in rafts.

For report of survey of this river see House Document No. 75, Fifty-sixth Congress, second session, and Annual Report of the Chief of Engineers for 1901, page 2542.

(b) *Hiwassee River*.—The Hiwassee River rises in the mountains of western North Carolina and northwestern Georgia, flows in a north-westerly direction and enters the Tennessee River about 35 miles above Chattanooga, Tenn. It has a number of tributaries, the largest of which is the Ocoee River, which enters it from the south about 35 miles from its mouth.

On examination made in 1874 the channel was found to be obstructed by rock reefs, gravel bars, snags, and overhanging trees. The railroad bridge of the Southern Railway crossing the river at Charleston, Tenn., about 19 miles above its mouth, is a complete obstruction to navigation during periods of high water, the most favorable for navigation.

The original project of improvement, based on the examination of 1874, was for a navigable channel 40 feet wide and 2 feet deep at ordinary low water to Savannah Ford, about 43 miles from the mouth of the river, to be secured by excavation of rock reefs and gravel bars and construction of wing dams. The sum of \$36,500 has been expended on this project.

The present project, based on a survey made in 1899 and report thereon submitted by Major Kingman (H. Doc. No. 77, 56th Cong., 2d sess.; also Report of Chief of Engineers for 1901, p. 2458), contemplates the development of a channel not less than 116 feet wide, 30 inches mean depth and 3 feet maximum depth, between the mouth of the river and the mouth of the Ocoee River, by the use of spur dikes, training walls and submerged sills, bank protection, and dredging, at an estimated cost of \$71,125.

This project was adopted by the river and harbor act of June 13, 1902.

The amount expended thereon to June 30, 1903, was \$3,873.74, and together with that expended under the previous project has been beneficial to navigation by lengthening the useful season and diminishing the dangers and cost of navigation. Small boats of about 100 tons capacity can navigate the river about eight months in the year. Savannah Ford, 7 miles above the mouth of the Ocoee River, has at times been reached by steamboats and is usually regarded as the head of steamboat navigation. The commerce on the Hiwassee River dur-

ing the calendar year of 1902 amounted to 16,041 tons, valued at \$340,207.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

(c) *Holston River*.—The Holston River rises in southwestern Virginia, flows in a southwesterly direction through eastern Tennessee, and unites with the French Broad $4\frac{1}{2}$ miles above Knoxville to form the Tennessee River.

In its original condition the channel was obstructed by rock reefs and ledges, bowlders, snags, and overhanging trees.

In 1830 it was examined with a view to its improvement by the State of Tennessee and a project developed, which was executed by the State.

The river and harbor act of March 3, 1899, authorized a survey of the river, the report of which is found in House Document No. 218, Fifty-sixth Congress, second session, and at page 2518, Annual Report of the Chief of Engineers for 1901. An estimate of \$5,000 for improvement by removal of channel obstructions and the cutting of overhanging trees was recommended, and this amount was appropriated by the river and harbor act of June 13, 1902.

The amount expended to June 30, 1903, was \$3,223.90, which resulted in clearing the channel of some of the worst obstructions.

The amount of commerce reported for the year 1902 was 9,136 tons, valued at \$81,694. This was all rafted. There is no regular upstream navigation of this river. Occasionally a small steamboat runs up 30 to 60 miles from the mouth during periods of high water.

July 1, 1902, balance unexpended	\$20,122.82
June 30, 1903, amount expended during fiscal year	11,291.59

July 1, 1903, balance unexpended	8,831.23
July 1, 1903, outstanding liabilities	793.66

July 1, 1903, balance available	8,037.57
---------------------------------------	----------

{ Amount (estimated) required for completion of existing project	^a 61,125.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	^a 3,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix E E 4.)

IMPROVEMENT OF OHIO RIVER BY OPEN-CHANNEL WORK AND CONSTRUCTION OF LOCK AND DAM NO. 37; OPERATING SNAG BOAT ON OHIO RIVER.

This district was in the charge of Col. G. J. Lydecker, Corps of Engineers.

1. *Ohio River (general open-channel improvement)*.—This work was commenced by the General Government in 1827, when low-water navigation over many of the bars and shoals was impossible for commercial purposes; but the improvements made and maintained since then have provided fairly convenient channels at such places for a profitable light-draft local freight and passenger service during low-water periods, and have greatly increased the convenience and safety of navigation for all

^a For Hiwassee River.

through commerce that is carried on at higher stages of water by the largest packets and the most powerful towboats with their deeply loaded fleets in tow. The difference in level of water surface of the river varies; at Cincinnati, nearly midway between the head and mouth of the river, this difference was 47 feet, and the average annual range at the same point during the past thirty years is 47.7 feet.

The project under which operations have been carried on has been a continuous and progressive one, the principal features of the work being the removal of snags, rocks, and wrecks from the general channel; the direct improvement of bars and shoals by dredging and rock excavation; the construction, repair, and maintenance of low dikes and dams, to concentrate and direct the flow of water in improved channels; bank protection and the construction and repair of levees where required in the interests of navigation; the construction, repair, and maintenance of ice piers and harbors; miscellaneous, including extensive surveys, establishment, care, and record of water gauges, establishment of harbor lines, regulation of encroachment and deposits on the banks of the river or in its channel, and the supervision of construction of bridges across the river. The length of river through which the work extends is but little short of 1,000 miles, and the total expenditure by the Government during the seventy-six years it has been in progress, exclusive of liabilities outstanding June 30, 1903, is \$6,377,492.06, making an annual average expenditure for improvements and their maintenance to date of \$84 per mile.

The principal operations of the last fiscal year included new work, as follows: Dredging channel 3,400 feet long, 210 feet wide, and 6 feet deep, through Five-mile bar (455 miles below Pittsburg, Pa.), where 120,115 cubic yards of cemented gravel, bowlders, and sand was excavated by the dredges, which also removed 52 large bowlders after they had been drilled and broken up by dynamite; continuation of rock excavation and dredging in making channel through bar at mouth of the Licking River (468.4 miles below Pittsburg, Pa.) by drilling and blasting 4,564 cubic yards of solid rock and excavating 28,121 cubic yards of rock, gravel, and sand; completion of new dike near mouth of Tradewater River (862 miles below Pittsburg, Pa.) by placing 4,956 cubic yards of rock to fill the opening that was left in the work when operations were suspended in the previous year; preliminary work was completed for locating and constructing ice piers at Maysville, Ky., and near Hockingport, Ohio, and provision made for completing both of these piers during the present working season if river conditions are favorable. Surveys covering a distance of 6.8 miles in the vicinity of Steubenville, Ohio, and 9.05 miles in the vicinity of Ironton, Ohio, and Ashland, Ky., were made for locating and marking harbor lines on both banks of the river, and surveys relating to contemplated open-river improvements were made in several sections of the lower river, aggregating 47.2 miles in length. Numerous examinations were made in connection with the prevention of illegal encroachments on the river banks and channel, and in supervising work under War Department permits for the construction of bridges across the river, filling out the banks, etc.

Reports of examinations made at various localities along the river under authority of the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

The nature of this open-channel improvement is such that the full benefit of work heretofore done can not be realized because the

improvement is not continuous, the unimproved portions affording less depth of channel than the improved sections, and so limiting the available draft for the whole river to that required for passing its shoalest parts. Continuous work and simultaneous operations at many places are necessary to remedy the trouble, and for this purpose the Government plant should be largely increased, in order that any great amount of work may be accomplished during the comparatively short periods to which effective operations must be limited each year on account of unfavorable river conditions. Several light-draft tow-boats, barges, and derrick boats for dike construction and removing rocks or other obstructions and two or more modern dredges of much greater capacity and better adapted to the varying kinds of work than any now in service are all urgently needed before anything approximating satisfactory progress can be expected; nor can the service of such plant be obtained under contract on this river. It has now become a question of the utmost importance to develop the extent to which an open-channel improvement can be made to meet the requirements of through commerce on this river, and especially so to determine how far up from its mouth this form of improvement will be likely to supply the prospective demands of navigation, and the downstream limit to which a lock-and-dam system will be essential. No argument is needed to show the comparative advantages of a reliable open-river navigation so far as that system is feasible, but whatever the system nothing less than a through channel that will be safely and conveniently navigable at all stages of water throughout the year can meet the requirements of the Ohio River commerce. And for either system a matter of urgent importance is the completion of the general survey of the river down to its mouth, in conformity with the survey recently completed down to the mouth of the Big Miami, 489.4 miles below Pittsburg, a little less than half the total length of the river. For these reasons it is recommended that the next appropriation for this work be at least \$400,000.

The commerce of the river during the past year, so far as indicated by statistics that the engineer officer in charge of the river has been able to obtain, was as follows: General merchandise, coal, etc., 12,202,017 tons; passengers, 4,517,635.

July 1, 1902, balance unexpended	\$497,783.85
December 10, 1902, amount received from sale of condemned property	46.85
	<u>497,830.70</u>
June 30, 1903, amount expended during fiscal year	123,233.87
July 1, 1903, balance unexpended	374,596.83
July 1, 1903, outstanding liabilities	7,894.61
July 1, 1903, balance available	<u>366,702.22</u>
July 1, 1903, amount covered by uncompleted contracts	<u>26,652.34</u>
{ Amount (estimated) required for completion of existing project	Indefinite.
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	400,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix F F 1.)

*Amount appropriated by deficiency act July 1, 1902, improving Ohio River between Cairo and Mound City, \$25,000, undrawn and not included in amount available.

2. *Lock and Dam No. 37, Ohio River.*—The river and harbor act approved June 13, 1902, provided for commencing this work by appropriating the sum of \$100,000 and authorizing its completion at a total cost not exceeding \$1,050,000 under the continuing-contract system.

Operations during the fiscal year were confined to local surveys, and critical examinations of the river bed by extensive borings with the purpose of selecting the best possible site within the limits specified by Congress. The results were satisfactory beyond expectation, a site having been selected at Fernbank that affords a good rock foundation at an average depth of only 12.9 feet below low water for the dam and of 9.7 feet below low water for the lock. The lands required on the Ohio side of the river for the lock and on the Kentucky side for the abutment of the dam have been surveyed and platted, and reasonable options have been obtained for the latter, but, owing to controversy between parties controlling, respectively, the fee and leasehold of property required on the Ohio side, condemnation proceedings are necessary for acquiring it, and they are now about to be commenced. In the meantime detailed plans and specifications for both lock and dam are being prepared and will be completed by the time the lands are acquired or before it. The total expenditure on account of the work to June 30, 1903, exclusive of outstanding liabilities, is \$12,127.06.

In order to provide for prosecuting the work of construction as rapidly as possible under the contracts that will soon be made it is estimated that an additional appropriation of \$250,000 should be made available for expenditure during the year ending June 30, 1905.

July 1, 1902, balance unexpended	\$100,000.00
Amount appropriated by sundry civil act approved March 3, 1903	400,000.00
	500,000.00
June 30, 1903, amount expended during fiscal year	12,127.06
July 1, 1903, balance unexpended	487,872.94
July 1, 1903, outstanding liabilities	250.00
July 1, 1903, balance available	487,622.94
{ Amount (estimated) required for completion of existing project	550,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	250,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix F F 2.)

3. *Operating snag boat on the Ohio River.*—The condition of the channel way of the Ohio, the necessity for continuous snag-boat work, and the benefits accruing therefrom to river commerce are plainly shown by the yearly reports of obstructions removed, which obstructions, if permitted to remain, would make navigation highly dangerous at ordinary stages and hazardous at any time.

The project for removing obstructions by a properly equipped snag boat was put in operation in 1876, the boat having been completed at a cost of \$125,125.24, and the expense of operating having been borne by appropriations for improving the Ohio River until 1890. The river and harbor act of September 19, 1890, provided \$25,000 yearly for this purpose, and the act of June 3, 1896, increased the yearly appropriation to \$50,000.

The amount expended on this work during the fiscal year ending June 30, 1903, was \$32,655.08.

As far as practicable removal of obstructions is carried on whenever permitted by the stage of water and the absence of dangerous ice, and during the last fiscal year the regular Ohio River snag boat, *E. A. Woodruff*, was in active service from July 1 to December 15, 1902, and from May 7 to June 30, 1903, the result of her work being the removal of dangerous obstructions from the channel as follows: Four hundred and sixty-one snags, whose weight aggregated 2,196 tons; 8 rocks, with total weight of 2.8 tons; 81 wrecks, viz, 48 coal barges, 24 coal boats, 3 steel-rail barges, 1 cinder barge, 1 fuel flat, 1 sand boat, and the hulls of 3 steamboats. The total number of miles run by the boat during the year was 6,983. In addition to the wrecks removed by the snag boat the U. S. launch *Wenonah*, equipped with explosives, destroyed 5 sunken coal boats and 4 coal barges, by which navigation near the head of the river was obstructed at times when the snag boat could not reach that locality.

The snag boat *Woodruff* is a powerful and finely equipped vessel that does admirable service during moderate stages of water, but can do little or nothing when the river is at a stage of less than 4 feet, though it is at such stages that snagging operations should be prosecuted most advantageously; but with no light-draft snag boat available it then becomes necessary to extemporize outfits for such work that are but little better than makeshifts, while the *Woodruff* remains idle. Though useful results are thereby obtained they do not approximate what could be gained if one or two light-draft boats, properly equipped and adapted for the work, formed a part of the regular plant pertaining to the general improvement of the Ohio River, and for this reason they should be included in the additional plant that is contemplated by the recommendation submitted in this year's report on that improvement (see Appendix F F 3, herewith.)

(See Appendix F F 3.)

IMPROVEMENT OF HARBOR AT PITTSBURG, PA., OF ALLEGHENY RIVER, PENNSYLVANIA, OF MONONGAHELA RIVER, WEST VIRGINIA AND PENNSYLVANIA; CONSTRUCTION OF LOCKS AND MOVABLE DAMS NOS. 2-7, OHIO RIVER, AND OPERATING AND CARE OF DAVIS ISLAND DAM, OHIO RIVER.

This district was in the charge of Capt. W. L. Sibert, Corps of Engineers, having under his immediate orders Lieut. Alfred D. Putnam, Corps of Engineers, since May 2, 1903. Division Engineer, Col. G. J. Lydecker, Corps of Engineers.

1. *Monongahela River, West Virginia.*—Navigation of the Monongahela River, West Virginia, was, in its original condition, impeded at high water by swift currents, the fall per mile being about 2 feet. At low stages it was obstructed by shoals and by numerous gravel and rock bars. Steamboat navigation was practicable at high stages as far upstream as Morgantown. Occasionally a boat could go as far upstream as Fairmont, and downstream navigation of flats and small rafts was practicable at medium and high stages.

The original project of the above portion of the Monongahela River is dated February 5, 1872, and contemplated the construction of Locks and Dams Nos. 8 and 9. This project was completed on November 8,

1889, with the result that boats drawing 5.2 feet of water could navigate the river in low water as far upstream as Morgantown, W. Va., the river having previously been slackwatered from its mouth to Lock No. 8 by the Monongahela Navigation Company. The amount expended under this project was \$436,900.

The existing project is dated February 3, 1897, and approved March 13, 1897, and provides for the construction of six locks and dams, Nos. 10 to 15, inclusive, between Morgantown and Fairmont, W. Va., at an estimated cost of \$1,200,000 for the six. The amount expended under this project at the close of fiscal year ending June 30, 1903, was \$825,939.50. None of this was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1903:

No. 10.—The lock and dam and all the appurtenances necessary to their operation and preservation are completed excepting a portion of the upper guide crib and the building of a section of the dam 133 feet long. This section of the dam was left open to facilitate the construction of Lock and Dam No. 11, and will not be built until Lock and Dam No. 11 are completed.

No. 11.—All masonry of this lock and of the guide and guard cribs is completed. The upper gate and one leaf of lower gate are completed and in place. The other leaf of the lower gate is about completed. The abutment and the retaining wall below it are completed and the slope above the latter is partially graded and paved with stone. The grading of lock grounds is about one-third completed. Paving of the lock premises has been commenced. The dam is about two-thirds completed. One lockmaster's dwelling is about two-thirds completed.

No. 12.—All walls of the lock, including guide and guard walls, are completed except the upper guide wall, which is about three-fourths completed. All of the paving and grading on the lock side of the river and the protection of the bank below the abutment are about completed. Three hundred and twenty-one linear feet of dam and the foundation for the remaining 104 linear feet are completed. The upper lock gate is completed and in place. The lower gate, sills, and hollow quoins are framed. The foundation for the lockmaster's dwelling is built.

No. 13.—The lock proper and the dam are completed. The grading of the lock grounds is about three-fourths completed. The upper lock gate is completed but not hung. The lower lock gate and the timber hollow quoins for intermediate and lower gates are about one-half framed. The paving and riprapping on the abutment side of the river are about two-thirds completed. The foundation for lockmaster's dwelling is completed.

No. 14.—A section of the left lock wall, 121 feet in length, and of the right lock wall, 83 feet in length, the upper guide wall, 100 feet in length, a section of the dam, 60 feet in length, and the core wall at abutment are completed. Timber for the gates is being framed. Foundation for the dwelling is built and the office building completed. Grading of lock grounds is about three-fourths completed.

No. 15.—All walls of the lock, excepting the upper guide wall, are completed. Forty feet of the dam is built. Grading of the lock grounds is about two-thirds completed, and the excavation for the channel at the lower entrance to the lock is about three-fourths completed. The gates are about two-thirds completed. The lockmaster's dwelling is about three-fourths completed.

No results in the way of increased depth or width or other facilities or advantages have resulted under the expenditure to date on the present project, and none will be obtained until the locks and dams under construction are completed.

The usual variation of level of water surface is 22 feet.

The stream is navigable by steamboats to a point about 3 miles above Morgantown, W. Va., and it is navigable for rafts to Fairmont, W. Va.

In that portion of the river already improved by Locks and Dams Nos. 8 and 9 the volume of business has materially increased over that originally existing in this part of the river. A daily line of packets plies the river between Pittsburg and Morgantown, and towboats make such trips as are necessary.

More extended information is given in Annual Reports of the Chief of Engineers for 1896 and 1898, pages 2134 and 2173, respectively.

A survey of the Monongahela River, between Geneva and Morgantown, will be found in House Executive Document No. 144, Forty-second Congress, second session, and from Morgantown to Fairmont, W. Va., in House Executive Document No. 91, Forty-fourth Congress, first session.

The traffic at Locks Nos. 8 and 9 during fiscal year ending June 30, 1903, was:

Lock No. 8:	
Freight.....	tons ^a 112, 326
Passengers.....	number.. 23, 240
Lock No. 9:	
Freight.....	tons ^a 92, 821
Passengers.....	number.. 18, 682
July 1, 1902, balance unexpended	\$802, 890. 17
June 30, 1903, amount expended during fiscal year	453, 829. 67
July 1, 1903, balance unexpended	349, 060. 50
July 1, 1903, outstanding liabilities	4, 037. 61
July 1, 1903, balance available	345, 022. 89
July 1, 1903, amount covered by uncompleted contracts.....	348, 705. 42
{ Amount (estimated) required for completion of existing project	100, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	100, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G G 1.)

2. *Monongahela River, Pennsylvania.*—That part of the Monongahela River in Pennsylvania extends from Pittsburg to the mouth of Dunkards Creek, a distance of 89 miles. In its original condition prior to 1840 it was navigable for steamboats only at high stages. A downstream navigation for light-draft flats and rafts was practicable at high and medium stages. The average fall per mile is about nine-tenths foot and the minimum discharge about 160 cubic feet per second.

In 1833 Congress provided for a survey of the river from Pittsburg to Brownsville, a distance of about 57 miles. This survey was not

^a2,000 pounds.

followed by an appropriation for improving the river, and the legislature of Pennsylvania, by act of March 31, 1836, incorporated and authorized the Monongahela Navigation Company to improve the river from Pittsburg, Pa., to the Virginia State line, a distance of 90½ miles. This company built 7 locks and dams, producing slack water from Pittsburg to within 2 miles of the West Virginia State line.

The river and harbor act of June 3, 1896, authorized and directed the Secretary of War to institute and carry to completion proceedings for condemnation of all the property and appurtenances of the company. The property was acquired by the United States on July 7, 1897.

The amount expended on original and modified projects prior to operations under existing project is \$3,769,073.88, including the purchase money.

The existing projects for the improvement are as follows:

Adopted by the act of March 3, 1899, providing for enlargement and improvement of Lock 6, certain accessory structures at Lock 3, and for additional pieces of floating plant, at an estimated cost of \$185,556.

Adopted by the act of June 13, 1902, providing for the rebuilding of Lock and Dam No. 2. The limiting cost is \$655,961.

The amount expended under these projects at close of fiscal year ending June 30, 1903, was \$138,306.88, none of which was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1903:

Locks 3 and 6 and floating plant.—All of the work of improvement at Locks 3 and 6 contemplated in existing project, except the purchase of certain land at Lock 6, has been completed. Of the floating plant provided for in existing project, the dredge and dump scows are completed, and the repair steamer with snagging appliances is nearly completed.

Rebuilding Lock No. 2.—The location of this lock has been decided upon and the purchase of the necessary land authorized. The price for this land has been agreed upon and the procurement of title is well under way. This work is being done by the United States district attorney for western Pennsylvania. Plans and specifications for this lock have been prepared and approved by the Engineer Department, and bids will be advertised for as soon as the title to the property has been accepted by the Attorney-General.

Usual variations of level of water surface, 25 feet.

The Monongahela River in Pennsylvania is navigable in fact for its entire length.

The aggregate tonnage of freight, principally coal, including iron and miscellaneous articles, on the river for eleven years was as follows:

Calendar year.	Tons.	Fiscal year.	Tons.
1892	4, 163, 304	1898	6, 117, 973
1893	4, 142, 644	1899	6, 964, 965
1894	4, 918, 089	1900	5, 994, 975
1895	4, 555, 703	1901	6, 856, 507
1896	5, 989, 159	1902	9, 100, 887
		1903	11, 369, 814

The traffic of the river is hampered and restricted by insufficient capacity and conveniences at the locks. This will probably be overcome in the project to be adopted in rebuilding and modernizing some of the lower locks and dams.

A history of the slack-water system of this river and an estimate of the cost of its enlargement and improvement to afford adequate accommodations for a large and growing traffic are given in Annual Report of the Chief of Engineers for 1897, pages 2412 to 2424, inclusive.

A report upon the commercial value and importance of the works of the Monongahela Navigation Company is printed in House Executive Document No. 112, Forty-ninth Congress, second session, and in Annual Report of the Chief of Engineers for 1887, page 1802.

A report of the Chief of Engineers on the subject of acquiring by purchase the locks and dams on Monongahela River, Pennsylvania, can be found in House Executive Document No. 249, Fifty-third Congress, third session. Testimony relative to value of improvement of Monongahela Navigation Company and to commercial importance of free navigation of said river can be found in House Document No. 78, Fifty-fourth Congress, first session, reprinted in the Annual Report of the Chief of Engineers for 1896, page 2142.

Report on examination and survey of Locks Nos. 1, 3, 4, and 5, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

An estimate for necessary improvements at Locks and Dams Nos. 5 and 6 is submitted, as follows:

Lock and Dam No. 5: New pile guide crib.....	\$1,300
Lock and Dam No. 6:	
Protection crib.....	750
Raising crest of dam	850
Purchase of river front.....	4,950
	7,850
July 1, 1902, balance unexpended.....	\$289,753.13
Amount appropriated by sundry civil act approved March 3, 1903.....	455,961.00
	745,714.13
August 18, 1902, amount carried to surplus fund.....	\$2,842.94
June 30, 1903, amount expended during fiscal year.....	39,661.07
	42,504.01
July 1, 1903, balance unexpended.....	703,210.12
July 1, 1903, outstanding liabilities.....	34,804.69
	668,405.43
July 1, 1903, balance available.....	668,405.43
July 1, 1903, amount covered by uncompleted contracts.....	48,230.00
	Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....
	7,850.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G G 2.)

3. *Operating and care of locks and dams, Monongahela River.*—The slack-water system of the Monongahela River comprises 9 dams and 13 locks. Locks 1 to 4 are double locks; 5 to 9 are single locks. The chambers of the large locks are 56 feet wide, and the shortest of these is 216 feet long in the clear. The chambers of the small

^a Unexpended balance in United States Treasury from appropriation of June 3, 1896, for "Costs of condemnation—property of Monongahela Navigation Company."

locks are 50 feet wide and 160 feet long in the clear. Controlling depths on sills at the different locks at pool surfaces vary from 4 to 6.7 feet. During low stages of water a depth of 8 feet is maintained below Dam 4 by placing flashboards on the dams and a depth of 6 feet above that point by placing flashboards on Dams 4, 5, and 6.

The original condition and scope of this improvement is described in the preceding summary report for improving Monongahela River, Pennsylvania.

The existing project is the operating and maintaining of Locks and Dams 1 to 9, inclusive.

The amount expended up to June 30, 1902, was \$929,348.47.

The locks were operated throughout the year, except when closed for short times for repairs and during floods and ice.

More or less work of repair or renewal at the various locks and dams was done during the fiscal year. The result was to enable the old locks of this system to pass through probably more commerce than any locks in the United States of similar capacity.

The amount expended during fiscal year ending June 30, 1903, for operating and care of the locks and dams was \$238,816.16.

Total commerce of the river.

Fiscal year.	Products.	Passengers.
	<i>Tons, a</i>	<i>Number.</i>
1902	9, 100, 887	181, 527
1903	11, 369, 814	101, 457

a 2,000 pounds.

The total commerce on the Monongahela River is obtained by summing up the maximum tonnage of the several kinds of freight passing any single dam. The coal item in this total is that passed down through Lock No. 3, plus that mined in the first and second pools.

(See Appendix G G 3.)

4. *Harbor at Pittsburg, Pa.*—This harbor comprises that portion of the Ohio River lying above Davis Island dam, a length of 4.7 miles; that portion of the Allegheny River lying between its mouth and Brilliant station, Allegheny Valley Railroad, a length of 7.3 miles, and that portion of the Monongahela River lying between its mouth and McKeesport, a distance of 15.5 miles; total length of harbor, 27.5 miles. That portion of the harbor most used as such, and called the lower harbor, lies between the Davis Island dam and Dams No. 1, on the Allegheny and Monongahela rivers, and measures 8 miles of river. In its original condition the lower harbor depths were from 3 to 4 feet on natural mean low river, and very often still lower stages caused suspension of navigation.

Since the completion of Davis Island dam, in 1885, the maximum draft which could be carried over the shoalest place was scant 8 feet at pool stage. Parts of the channel are from 10 to 12 and from 16 to 20 feet in depth. The average widths of the harbor at pool surfaces are: On the Ohio, about 1,100 feet; on the Allegheny, about 930 feet; and at different parts of the Monongahela, from about 750 to 950 feet. The capacity of the harbor is impaired by shoal places and high dumps

projecting from the banks. The use for harbor purposes of that portion of the harbor in the Allegheny River is practically nullified by the low bridges in that stream. The clear heights of these bridges above their respective pool surfaces are from $27\frac{1}{2}$ to $35\frac{1}{2}$ feet. The least height, with chimneys down, of the packets that ply between Pittsburg and points on the Ohio, Kanawha, and Muskingum rivers is 45 feet. The average height of the Ohio River towboats, with chimneys down, is 44 feet. The height of a suitable packet for the Allegheny River is about 33 feet and of a suitable towboat about 28 feet. The result is that practically none of the coal and iron or steel products intended for Southern shipments is loaded or harbored in the Allegheny River.

In 1858 the State of Pennsylvania, through a board of commissioners, made a detailed survey of the rivers at and near Pittsburg and laid down on the maps high and low water lines, and marked such lines on the ground by monuments. No means, however, were provided for preserving the monuments nor for preventing the filling of the river riverward of these lines.

In 1894 a Board of Engineer officers recommended certain harbor lines for the harbor of Pittsburg from the Davis Island dam to Brilliant and to Homestead. The recommended lines generally followed the actual banks as they existed at the time. These lines were approved by the Secretary of War January 29, 1895. An extension of these lines on the Monongahela River from Homestead to McKeesport was approved by the Secretary of War April 3, 1902. Harbor lines on the Monongahela River from Elizabeth to Wilson, 3 miles, were established by the Secretary of War February 3, 1903.

The original and existing project for improvement was adopted by the river and harbor act of March 3, 1899, and provided for dredging a channel through the lower harbor (below Dams Nos. 1 on the Allegheny and Monongahela rivers), where needed, 10 feet deep at pool, and 500 feet wide below Smithfield Street Bridge, Monongahela River, and above this bridge, and in the Allegheny River of a less width, and one limited by lines from ends of channel spans of adjoining bridges, except at the Pan Handle Railroad bridge, where the dredged channel under modified project is to have a width of 570 feet; for raising the old riprap dam across Brunot Island channel, Ohio River; for removing abandoned structures and unauthorized and obstructive fillings projecting from the banks beyond the harbor lines; for marking of harbor lines, and for inspecting and patrolling the harbor; all at an estimated cost of \$110,662.90, exclusive of maintenance after the first year of \$10,000 annually.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, was \$107,176.61. None of this was applied to maintenance.

Condition of work at end of fiscal year ending June 30, 1903: The project for channel dredging on the Monongahela River, including the modification providing for wider channel at the Pittsburg, Cincinnati, Chicago and St. Louis Railroad bridge, has been finished from Lock No. 1 to shortly below the said bridge. From this point downstream to lower end of the projected dredged channel near Market street, of the required channel 500 feet in width, 300 feet has been made. In the Allegheny River near its mouth a channel 1,200 feet long and 180 feet

wide has been made. By directing the work of sand dredgers operating under permits of the Secretary of War, a channel was made through Garrison bar, Allegheny River, about 1,200 feet long and 150 feet wide, and by the same means a channel through a shoal in the upper end of the Ohio River was improved. The raising of the dam at Brunt Island has been completed. The harbor lines on the Monongahela River have been completely marked on both banks from the mouth of the river to Dam No. 2, and above this at some places where urgently needed. In all, 85 per cent of the lines of the Monongahela River have been marked. On the Allegheny River the lines have been marked from the mouth to the Sharpsburg bridge, and at some other places above where most urgent, making in all about 89 per cent of the lines on this river that have been marked. On the Ohio River surveys for location of points for marking the established harbor lines have been extended from Davis Island dam to near head of Brunot Island.

The maximum draft that could be carried June 30, 1903, at pool-full stage over the shoalest part of the locality under improvement is 10 feet. The usual variation of level of water surface is 20 feet.

Report of a Board of Engineers, dated August 10, 1903, made in compliance with requirements of section 1 of the river and harbor act of June 13, 1902, on examination of Pool No. 1, Ohio River (Davis Island Pool), Pittsburg Harbor, with estimate of cost of securing increased depth and additional harbor facilities, is herewith as Appendix G G 10.

The principal commercial uses of the harbor are the mooring of coal fleets awaiting a rise in the Ohio for proceeding to destination on that river or on the lower Mississippi, the mooring of timber rafts and boat bottoms coming down the Allegheny River on rises, the delivery of coal and other materials to mills, furnaces, steel plants, and yards, and the accommodation of the several packet lines plying on the three rivers, and whose routes terminate at the harbor. Besides coal, steel rails, cotton ties, sheet iron, wire, nails, etc., are shipped by barges in considerable quantities.

Commercial statistics.

Calendar year.	Products.	Passen- gers.
	Tons, a	Number.
1900	8, 141, 451	844, 415
1901	10, 916, 489	817, 800
1902	12, 252, 405	996, 500

a 2,000 pounds.

More extended information as to establishment of harbor lines at Pittsburg is given in Annual Report of the Chief of Engineers for 1895, page 2420; modification of harbor lines on Monongahela River in Annual Report of the Chief of Engineers for 1896, page 2215; and in Ohio River at Allegheny City in Annual Report of the Chief of Engineers for 1899, page 2449; project for dredging, marking harbor lines, inspection, surveys at Pittsburg Harbor in Annual Report of the Chief of Engineers for 1899, page 2399.

July 1, 1902, balance unexpended	\$47,029.19
June 30, 1903, amount expended during fiscal year	33,542.90
July 1, 1903, balance unexpended	13,486.29
July 1, 1903, outstanding liabilities	1,144.58
July 1, 1903, balance available	12,341.71
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix G G 4.)

5. *Operating and care of Davis Island dam, Ohio River, near Pittsburg, Pa.*—This dam is a movable dam and is the first of a series for the improvement of the upper portion of the Ohio River. The chamber of the lock is 110 feet wide and 600 feet long in the clear. The improvement was completed in 1885 at a cost of about \$940,000. The dam was built to secure a low-water depth of 6 feet, and has proved a great benefit to commerce in general, and especially to coal interests, by allowing the harborage of coal at Pittsburg in large quantities while awaiting stages of water suitable to the passage of boats down the river.

The existing project is the operating and maintenance of the Davis Island dam.

The amount expended up to June 30, 1902, was \$298,279.64. This expenditure was made in operating the lock and in renewing and making repairs to various parts of the lock and dam and other appurtenances. The result was to make the lock efficient for its purposes at all times when its operation was practicable.

The amount expended during fiscal year ending June 30, 1903, for operating and care of Davis Island dam was \$43,267.74.

Commerce passing Davis Island dam.

Fiscal year.	Freight.
1903.....	Tons, a 4,724,938

a 2,000 pounds.

(See Appendix G G 5.)

6. *Construction of Locks and Dams Nos. 2 to 7, inclusive, Ohio River, in Pennsylvania.*—[This work was in the charge of Capt. W. E. Craig-hill, Corps of Engineers, to March 1, 1903, and of Maj. G. A. Zinn, Corps of Engineers, from that date to March 16, 1903.] A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the appropriation act for the year 1875-76 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The project for Dams Nos. 2, 3, 4, and 5 is contained in House Document No. 209, Fifty-fourth Congress, first session (see Annual Report for 1896, p. 2120); that for Dam

No. 7 in House Document No. 122, Fifty-fifth Congress, third session (see Annual Report for 1899, p. 2361).

When the entire system is completed it will provide for 6-foot navigation. At present the harbor at Pittsburg is benefited alone, as the dam about 5 miles below is the only one in operation.

The cost of the locks and dams is estimated at from \$850,000 to \$950,000 each, although the present market prices would indicate that the work can not be accomplished within the estimate.

The following is a statement of the condition of the works:

Dam No. 2.—The lock and 500 feet of the navigable pass are completed and the gravel bar above and below is now being removed so that navigation can pass over this completed part during the construction of the remainder of this dam.

Dam No. 3.—The masonry of this lock is completed. A temporary channel 300 feet wide and 5,000 feet long for use during the construction of the navigable pass is about completed. Bids are now being advertised for the construction of 600 feet of navigable pass, exclusive of wickets. It will cost \$40,000, not covered by any existing projects, to properly protect the walls and guide walls of this lock.

Dam No. 4.—The masonry of this lock is completed and about 100 feet of the navigable pass, 500 feet of which is under contract. The area above the upper lock-gate recesses has been paved. A temporary channel was dredged at this site for the benefit of navigation during dam construction. It will cost \$40,000, not covered by any existing projects, to properly protect the walls and guide walls of this lock.

Dam No. 5.—The masonry of the lock has been completed. Contract was entered into August 16, 1902, for the construction of substructure for 400 feet of navigable pass. Cofferdam for this was completed in November, and during last winter it was seriously damaged. Repairs to cofferdam were commenced June 10, 1903, and are now in progress. Both the land and river wall of this lock were undermined during the floods of last winter, and it will be necessary to rebuild about 160 feet of the land wall, at an estimated cost of \$60,000, not provided for in any existing project. The work necessary in addition to this, to protect the entire lock from injurious scour in the future, will cost about \$40,000, not covered by any existing projects.

Dam No. 6.—The lock and dam are now practically complete except the construction of the gates, the power house, the lock-keepers' dwellings, the installation of the necessary machinery for operating the lock, and some minor modifications to the A-frame dam. The date of opening this lock will depend upon the date of completion of the lock gates, which are now under contract with the Penn Bridge Company, of Beaver Falls, Pa. The contract time for the completion of the gates is July 18, 1904.

Dam No. 7.—The location of this lock has been decided upon, and the acquisition of the property necessary for the construction and maintenance of the lock is now under way.

The amount expended on the above works to June 30, 1903, is as follows:

Dams Nos. 2, 3, 4, and 5	\$1,520,330.88
Dam No. 6	908,820.98
Dam No. 7	9,268.10
Total	2,438,419.96

^a Of this amount \$8,575.55 was expended in maintaining completed work at Lock 5.

For commercial statistics see report for operating and care of Davis Island dam.

CONSOLIDATED.

July 1, 1902, balance unexpended	\$1,086,015.39
Amount appropriated by sundry civil act approved March 3, 1903	300,000.00
June 30, 1903, amount expended during fiscal year	1,386,015.39
	306,435.35
July 1, 1903, balance unexpended	1,079,580.04
July 1, 1903, outstanding liabilities	34,323.32
July 1, 1903, balance available	1,045,256.72
July 1, 1903, amount covered by uncompleted contracts	310,376.72
{ Amount (estimated) required for completion of existing project	2,007,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	1,400,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAMS NOS. 2, 3, 4, AND 5.

July 1, 1902, balance unexpended	^a \$887,722.04
Amount appropriated by sundry civil act approved March 3, 1903	300,000.00
June 30, 1903, amount expended during fiscal year	1,187,722.04
	266,494.72
July 1, 1903, balance unexpended	^b 921,227.32
July 1, 1903, outstanding liabilities	12,330.59
July 1, 1903, balance available	908,896.73
July 1, 1903, amount covered by uncompleted contracts	292,850.03
{ Amount (estimated) required for completion of existing project	1,180,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	1,000,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 6.

July 1, 1902, balance unexpended	\$175,293.35
June 30, 1903, amount expended during fiscal year	30,672.53
July 1, 1903, balance unexpended	^c 144,620.82
July 1, 1903, outstanding liabilities	15,852.54
July 1, 1903, balance available	128,768.28
July 1, 1903, amount covered by uncompleted contracts	16,753.73

^aThe balance unexpended July 1, 1902, was erroneously reported in Report of 1902 as \$1,187,722.04. It is noticed that \$400,000 was taken up as appropriated by act of June 13, 1902, instead of \$100,000. The remaining \$300,000 was pledged June 13, 1902, but not appropriated until March 3, 1903.

^b\$500 was received during the year for sale of property to Lock 11, Ohio River.

^cThe Mercantile Trust Company during the year paid \$6,764.49 in compromise of suit brought by the Government against them as surety on failing contract of Hulings Brothers for building pass at Lock 6.

DAM NO. 7.

July 1, 1902, balance unexpended	\$23,000.00
June 30, 1903, amount expended during fiscal year	9,268.10
July 1, 1903, balance unexpended	13,731.90
July 1, 1903, outstanding liabilities	6,140.19
July 1, 1903, balance available	7,591.71
July 1, 1903, amount covered by uncompleted contracts	772.96
{ Amount (estimated) required for completion of existing project	827,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	400,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix G G 6.)

7. *Locks and dams at Herr Island, head of Six-mile Island, and at Springdale, Allegheny River.*—Prior to the completion in 1885 of the Davis Island dam in the Ohio River, 5 miles below its head, it was impossible to navigate the Allegheny River with steam craft of lightest draft during low-water periods, which frequently continued for months at a time. Since then a navigable depth of 8 feet has been afforded by that dam, when raised, to Garrison Ripple, 2 miles up the stream. Herr Island dam, located one-half mile below Garrison Ripple, was designed to extend slack-water navigation about 4 miles, to the city limits of Pittsburg, and at the same time form the first step toward the radical improvement of the Allegheny.

The original project, adopted September 29, 1890, contemplated a lock and fixed dam, but the dam was subsequently changed to a movable one at the request of various local interests. The then estimated cost of the improvement was \$600,000, exclusive of cost of site, for which \$32,689.25 was paid.

The river and harbor act of June 3, 1896, provided for the further extension of slack water to Natrona, 22 miles above Herr Island dam, by the construction under continuing contracts of two additional locks and dams at a limiting cost, including the completion of Herr Island dam, of \$1,132,000.

Under the general project approved March 13, 1897, it was provided that Dams Nos. 2 and 3 should be fixed timber structures and the locks concrete. The lock at Herr Island is also of concrete construction. The Herr Island dam comprises a 500-foot navigable pass of Chanoine wickets and two bear-trap weirs, each 94 feet long.

The expenditures on the works to the close of the year ending June 30, 1903, were \$811,720.89.

Condition of work at end of fiscal year ending June 30, 1903:

Lock and dam at Herr Island (No. 1).—This structure was completed and assigned to operating and care of canals, etc., on January 1, 1903.

Lock and dam at Six-mile Island (No. 2).—The cofferdam for construction of lock proper is about completed, and the excavation for the lock about one-third completed.

Lock and dam at Springdale (No. 3).—The lock and dam are completed except building and placing lock gates and setting the valves and operating gear, and the construction of the dam from 1 foot above low water to top, and the paving and grading of the grounds and construction of lockmaster's dwelling.

The completion of Herr Island dam, which extends Pittsburg Harbor up the Allegheny River for a distance of 4 miles, with a navigable depth of 8 feet, is of immense benefit to the manufacturing plants along the banks of the Allegheny River within this reach, connecting them with the harbor of Pittsburg and with the coal fields of the Monongahela River. No benefit will be derived from the work done in the construction of Locks Nos. 2 and 3 until the said locks are completed.

For the calendar year 1902 the commerce reported on that part of the river under improvement for slack-water navigation was approximately 1,688,000 tons of freight and 54,000 passengers, as against 2,200,000 tons of freight and 50,000 passengers reported for 1901.

July 1, 1902, balance unexpended	\$429,255.29
June 30, 1903, amount expended during fiscal year	108,976.18
July 1, 1903, balance unexpended	320,279.11
July 1, 1903, outstanding liabilities	5,249.49
July 1, 1903, balance available	315,029.62
July 1, 1903, amount covered by uncompleted contracts	295,842.77
Amount (estimated) required for completion of existing project	(a)

(See Appendix G G 7.)

8. Operating and care of Herr Island dam (No. 1), Allegheny River.—This is a movable dam, and is the first to be completed of a series of three dams authorized by Congress for the Allegheny River. This structure was assigned to "Operating and care of canals," etc., on January 1, 1903. Its pool extends slack water to near Brilliant, a point 6 miles above the mouth of Allegheny River.

The existing project is the operating and maintenance of Herr Island dam.

The amount expended during six months of fiscal year ending June 30, 1903, was \$5,233.62.

Commerce passing Herr Island dam.

	Freight.
Six months, fiscal year 1903	Tons. ^a 319,487

^a2,000 pounds.

The above report of traffic includes, in the half-year period covered, the months of January, February, and March, during which navigation on the Allegheny is necessarily very light, owing to the large quantities of heavy ice the river puts out at that time.

(See Appendix G G 8.)

9. Allegheny River, Pennsylvania.—In its original condition the Allegheny River abounded in obstructions, such as bowlders, snags, islands, bars, and wide-spreading shoals, all of which rendered naviga-

^aIn report printed in House Document No. 371, Fifty-seventh Congress, first session, it was estimated that the completion of this project will cost \$148,732 more than the limiting cost fixed by Congress, but this increased estimate has not yet been adopted by Congress.

tion at best hazardous and practicable only at such high stages of water as would enable craft to clear the obstructions. Necessarily this condition resulted in frequent losses to river interests, and because of these obstructions navigators were deprived of a considerable portion of what should have been the navigable period.

The project adopted in 1878 and 1880, and which still continues, contemplated only the removal of the bowlders and snag obstructions and the construction of low dams and dikes to close secondary channels and concentrate the low-water flow on shoals.

The amount expended under this project to the close of the year ending June 30, 1903, was \$257,243.67, fully one-half of which was applied to maintenance. The work done has not increased the depth of water, generally speaking, except where dikes or dams have been built, but the removal of the obstructions has made it possible to utilize the entire flow of the stream, so that now navigators may operate safely on stages 1 to 2 feet lower than formerly.

The present condition of the channel is generally satisfactory, having been largely cleared of the more objectionable obstructions. But to maintain this condition it is necessary to annually remove any bowlders or snags brought in by the tributaries or carried along by ice and freshets. The dikes and dams are also becoming old and require frequent repairs.

During the past fiscal year repairs were made to Red Bank dike and Nicholson Island dam, and obstructions were removed in the channel between Warren and Tionesta.

Except on the lower 25 miles of river, the principal traffic consists in the downstream transportation of timber and lumber rafts, new coal-boat bottoms, barges, and flats, usually loaded with tan bark, hay, lumber, and other timber products, and the towage of gravel, sand, stone, etc. Steamboating above Kittanning is gradually falling off, principally because of the obstructive low bridges along this section. The tonnage reported on the portion of the river above slack-water improvements in progress was, for the calendar year 1902, 401,590 tons and number of passengers 6,000. The tonnage of freight reported for 1901 was 425,000, of which 40,076 tons was traffic reported on portion of Allegheny River lying in the State of New York.

Results bearing a proper relation to the expenditure for any further extended improvement of this stream can not be expected unless such improvement be accompanied by the raising of the low bridges.

July 1, 1902, balance unexpended	\$10,940.92
June 30, 1903, amount expended during fiscal year	8,184.59

July 1, 1903, balance unexpended	2,756.33
July 1, 1903, outstanding liabilities	13.73

July 1, 1903, balance available	2,742.60
---------------------------------------	----------

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10,000.00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix G G 9.)

CONSTRUCTION OF LOCKS AND MOVABLE DAMS IN OHIO RIVER BETWEEN THE PENNSYLVANIA STATE LINE AND CINCINNATI, OHIO, AND IMPROVEMENT OF KANAWHA, LITTLE KANAWHA, ELK, AND GAULEY RIVERS, WEST VIRGINIA.

This district was in the charge of Capt. W. E. Craighill, Corps of Engineers, to March 1, 1903, and of Maj. George A. Zinn, Corps of Engineers, since that date. Division Engineer, Col. G. J. Lydecker, Corps of Engineers.

1. *Movable dams, Ohio River.*—A general description of the Ohio River is contained in the Annual Report of the Chief of Engineers for 1896, page 2062. The system of improvement of this river by movable dams was approved by Congress in the appropriation act for the year 1875–76 (construction of dam at Davis Island—first dam below Pittsburg). The act of September 19, 1890, provided for the construction of a dam at or near Beaver, Pa., known as No. 6. The above represent practically the original projects for the slack-water system of the Ohio. The project for Dams Nos. 8 to 18, inclusive, is contained in House Document No. 122, Fifty-fifth Congress, third session (see Annual Report of the Chief of Engineers for 1899, p. 2361), and that for Dam No. 19 in House Document No. 336, Fifty-seventh Congress, first session (see Annual Report of the Chief of Engineers for 1902, p. 1867).

When the entire system is completed it will provide for 6-foot navigation. At present the harbor at Pittsburg is benefited alone, as the dam at Davis Island, about 5 miles below, is the only one in operation.

The cost of the locks and dams is estimated at from \$850,000 to \$950,000 each; the present market prices would indicate, however, that the work can not be accomplished within the estimate.

The following is a statement of the condition of the works:

Dam No. 8.—The site has been located and approved and the land is being acquired.

Dam No. 11.—A site has been located.

Dam No. 13.—Work on the lock is progressing very slowly, owing to the nature of the river bottom, which necessitated modifications in the plans. Under the contract for building masonry of lock, the greater part of the river-wall foundation has been built to a height of 8 feet, and three-fourths of the power-house foundation was completed.

Dam No. 18.—A contract was made for building the lock and guide walls, and work thereunder was progressing favorably at the close of the year.

Dam No. 19.—The site has been located and approved, and the land is being acquired.

The amount expended on the above works to June 30, 1903, is as follows:

Dam No. 8.....	\$12,143.33
Dam No. 11.....	10,081.06
Dam No. 13.....	97,542.63
Dam No. 18.....	33,995.67
Dam No. 19.....	8,679.23

162,441.92

For commercial statistics see reports for improving Ohio River and operating and care of Davis Island dam.

CONSOLIDATED.

July 1, 1902, balance unexpended	^a \$721,887.91
Amount appropriated by sundry civil act approved March 3, 1903	850,000.00
	<u>1,571,887.91</u>
June 30, 1903, amount expended during fiscal year	102,729.33
	<u>1,469,158.58</u>
July 1, 1903, balance unexpended	1,469,158.58
July 1, 1903, outstanding liabilities	2,426.72
	<u>1,466,731.86</u>
July 1, 1903, balance available	1,466,731.86
July 1, 1903, amount covered by uncompleted contracts.....	587,363.45
	<u>2,718,400.00</u>
{ Amount (estimated) required for completion of existing project	2,718,400.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	1,293,400.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 8.

July 1, 1902, balance unexpended	\$50,000.00
Amount appropriated by sundry civil act approved March 3, 1903	200,000.00
	<u>250,000.00</u>
June 30, 1903, amount expended during fiscal year	12,143.33
	<u>237,856.67</u>
July 1, 1903, balance unexpended	237,856.67
July 1, 1903, outstanding liabilities	135.00
	<u>237,721.67</u>
July 1, 1903, balance available	237,721.67
July 1, 1903, amount covered by uncompleted contracts.....	660.49
	<u>600,000.00</u>
{ Amount (estimated) required for completion of existing project	600,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	^b 200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 11.

July 1, 1902, balance unexpended	\$50,000.00
Amount appropriated by sundry civil act approved March 3, 1903	200,000.00
	<u>250,000.00</u>
June 30, 1903, amount expended during fiscal year	10,081.06
	<u>239,918.94</u>
July 1, 1903, balance unexpended	239,918.94
July 1, 1903, outstanding liabilities	146.50
	<u>239,772.44</u>
July 1, 1903, balance available	239,772.44
July 1, 1903, amount covered by uncompleted contracts.....	2,000.00
	<u>600,000.00</u>
{ Amount (estimated) required for completion of existing project	600,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	^b 200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

^a Dam No. 13, repayment 50 cents.^b Of this amount \$50,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

DAMS NOS. 13 AND 18.

July 1, 1902, balance unexpended	^a \$596, 887. 91
Amount appropriated by sundry civil act approved March 3, 1903.....	450, 000. 00
	<u>1, 046, 887. 91</u>
June 30, 1903, amount expended during fiscal year	71, 825. 71
July 1, 1903, balance unexpended	975, 062. 20
July 1, 1903, outstanding liabilities	2, 020. 22
	<u>973, 041. 98</u>
July 1, 1903, balance available	<u>534, 702. 96</u>
{ Amount (estimated) required for completion of existing project.....	593, 400. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	593, 400. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

DAM NO. 19.

July 1, 1902, balance unexpended	\$25, 000. 00
June 30, 1903, amount expended during fiscal year	8, 679. 23
July 1, 1903, balance unexpended	16, 320. 77
July 1, 1903, outstanding liabilities	125. 00
	<u>16, 195. 77</u>
{ Amount (estimated) required for completion of existing project.....	925, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	300, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix H H 1.)

2. *Little Kanawha River, West Virginia.*—A description of the original condition of the river and its availability for purposes of commerce is given in the Annual Report of the Chief of Engineers for 1875, page 740.

The original project provided for removing rocks, snags, overhanging and fallen trees above Burning Springs, W. Va., at a cost of \$7,300, as approved by Congress on August 14, 1876. The act of Congress of June 14, 1880, made provision for the construction of a lock and dam about 2 miles above Burning Springs. This lock and dam was opened to navigation on December 2, 1891, and has been maintained under the indefinite appropriation for operating and care of canals and other works of navigation.

The amount expended to June 30, 1903, is \$213,384.34.

The four locks and dams owned by the navigation company and the Government lock and dam afford 4-foot navigation from Parkersburg to Creston, W. Va., 48 miles. Owing to the bad condition of the former structures, this depth is not maintained during the low-water season. The maximum draft which can be carried at mean low water over the shoalest place in that part of the river under maintenance of improvement is 6 inches. Flatboat navigation extends to Burnsville, W. Va., about 120 miles above Parkersburg.

^a Dam No. 13, repayment 50 cents.

No work of maintenance was done during the year, under the appropriation of \$1,000 by act of June 13, 1902. Under the provision of this act, calling for report and estimate on the advisability of the Government acquiring possession of the locks and dams not owned by the United States, the greater part of the necessary data has been collected. Report thereon, and on examination with a view to extending work of improvement up to Burnsville, will be submitted to Congress in December, 1903.

A statement of the commerce is given in the report for operating and care of lock and dam on Little Kanawha River, West Virginia.

July 1, 1902, balance unexpended	\$1,171.74
Amount received from sale	61.10
	1,232.84
June 30, 1903, amount expended during fiscal year	138.08
July 1, 1903, balance unexpended	1,094.76
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	1,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix H H 2.)

3. *Operating and care of lock and dam on Little Kanawha River, West Virginia.*—The lock and dam, known as "No. 5," was built under the appropriation for improving the Little Kanawha River, West Virginia, being a part of the original project, as given in the Annual Report of the Chief of Engineers for 1875, page 740.

The amount expended for operating and care of this work to June 30, 1903, is \$31,510.35, of which \$2,083.97 was expended during the past year.

The lock was operated during the entire year, except for seventy-three days owing to low water, floods, and ice. Such repairs as were found necessary were made to the lock and dam. They were in good condition at the close of the year.

The lock and dam provide 4 feet at mean low water, but owing to the leaky condition of the dams below, owned by the Little Kanawha Navigation Company, the depth is often less.

The commerce that passed Lock No. 5 during the calendar year 1902 amounted to 69,706 tons, of which 64,687 tons consisted of timber and lumber; 5,762 passengers were carried. This decrease in freight carried is partly due to Lock No. 1 (of the navigation company) having been out of repair, which prevented steamboat connection with the Ohio River.

(See Appendix H H 3.)

4. *Kanawha River, West Virginia.*—A description of the condition of the river, the projects, and the general work accomplished (the locks and dams being in operation) is contained in the Annual Report of the Chief of Engineers for 1900, page 490.

The amount expended under the original project is \$50,000; that expended under the present project to June 30, 1903, is \$4,013,819.80.

Work on this improvement, as provided in the modified project for the expenditure of the funds appropriated June 4, 1897, is practically

completed, except constructing three guard cribs at Lock No. 3 and some dredging. During the past fiscal year considerable dredging was done, and the following betterments were made: Built porch additions to lock houses at Nos. 5, 7, and 11, completed 17 cisterns, built a retaining wall at No. 11, and the new towboat and dump scow, under contract, were received.

As there will be an available balance from the funds last appropriated, it should be used in making betterments which are essential to provide properly for navigation.

The maximum draft which can be carried at the shoalest part of the slack-water system at mean low water is 6 feet. Loup Creek shoal, about 90 miles above Point Pleasant, W. Va., is the head of navigation; the last 3 miles, however, requires considerable dredging to provide for continuous coal shipments.

It is expected that report of the examination and survey of the river between Lock No. 2 and the Falls, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

For commercial statistics, see report for operating and care of locks and dams on Kanawha River, West Virginia.

July 1, 1902, balance unexpended	\$172, 649. 72
June 30, 1903, amount expended during fiscal year	28, 269. 52
July 1, 1903, balance unexpended	144, 380. 20
July 1, 1903, outstanding liabilities	1, 523. 72
July 1, 1903, balance available	142, 856. 48
July 1, 1903, amount covered by uncompleted contracts	5, 101. 92
(See Appendix H H 4.)	

5. *Operating and care of locks and dams on Kanawha River, West Virginia.*—Under the projects for improving the Kanawha River 10 locks and dams were built, 2 fixed dams and 8 movable (Chanoine type), extending slack-water navigation for a distance of 90 miles from the Ohio River. The maintenance of these works is provided for by the indefinite appropriation for operating and care of canals and other works of navigation.

The location of each lock and dam, and year in which completed, is given in the Annual Report of the Chief of Engineers for 1899, page 428.

The total amount expended in operating and care of these works to June 30, 1903, is \$532,425.50, of which \$74,389.63 was expended during the past year.

High water and ice interrupted navigation for sixteen days at Locks Nos. 2 and 3 (fixed dams), and the repair of the dam at No. 3 a further three days. The movable dams were operated without notable accident.

Owing to the length of service of most of the works on this river considerable renewal is now required, and the cost of maintenance is increasing from year to year. The works were kept in practically good condition during the year.

The commerce for the past year is 1,090,797 tons, of which 937,880 tons was coal and 90,218 tons timber products. The large decrease in the coal shipments is partly due to the strikes along the river.

(See Appendix H H 5.)

6. *Gauley River, West Virginia*.—A description of the conditions, project, etc., is contained in the Annual Report of the Chief of Engineers for 1900, page 494.

The amount expended to June 30, 1903, is \$14,761.05.

Owing to the small amount available, this work was closed in September, 1902, and the property belonging thereto transferred to the Kanawha River improvement.

July 1, 1902, balance unexpended	\$261.73
June 30, 1903, amount expended during fiscal year	\$22.78
Amount deposited	238.95
	261.73

7. *Elk River, West Virginia*.—A description of the conditions, project, etc., is contained in the Annual Report of the Chief of Engineers for 1900, page 493.

The amount expended to June 30, 1903, is \$30,259.12.

This work was closed in September, 1902, after transferring its property to the Kanawha River improvement.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$240.88
Amount deposited during fiscal year	240.88

(See Appendix H H 7.)

IMPROVEMENT OF MUSKINGUM RIVER, OHIO, OF GUYANDOT RIVER, WEST VIRGINIA, OF BIG SANDY RIVER AND ITS FORKS, WEST VIRGINIA AND KENTUCKY, AND OF KENTUCKY RIVER, KENTUCKY.

This district was in the charge of Lieut. Col. E. H. Ruffner, Corps of Engineers. Division Engineer, Col. G. J. Lydecker, Corps of Engineers, to April 13, 1903.

1. *Muskingum River, Ohio*.—The original condition of the waterway and its availability for purposes of commerce are given in the Annual Report of the Chief of Engineers for 1900, page 488.

The report is limited to work carried on under an appropriation of \$102,000 by act of August 11, 1888, for the construction of a lock at Taylorsville and the reconstruction of the lock at Zanesville, Ohio; an appropriation of \$6,000 included in the sundry civil act of July 1, 1898, for the repair and extension of the levee at Zanesville, Ohio, and an appropriation of \$10,300 by act of June 13, 1902, for continuing improvement. By act of Congress approved August 18, 1894, the reconstruction of the Zanesville lock was indefinitely postponed and the money originally appropriated for it was diverted to other purposes. The amount expended on the original and modified projects prior to operations under existing project is \$106,989.03.

The existing project for expenditure of the appropriation in the river and harbor act approved June 13, 1902, is to raise the crest of one dam and build lock houses at four locks. The estimate of cost is \$10,400. Up to the close of the fiscal year ending June 30, 1903, \$107.90 had been expended on the work of this project.

The minimum sill depth is the controlling mean low-water depth of the system. This is 6 feet at all the locks except the lower sills of

Locks 1 and 4, where it is 3 feet and 5 feet, respectively. The usual variation of water surface is 38 feet at Lock 1 and 24 feet at Lock 10. The head of slack-water navigation is 8.2 miles above Dam 10 at Zanesville, or 84 miles above the mouth of river.

The commercial statistics for this work can not be separated from the general commerce of the Muskingum River, and are reported under the head of operating and care of locks and dams on the river.

The depth of the lower miter sill at Lock 4 is 1 foot less than the ruling depth over the sills of the other locks. To secure the required depth at this place it will be necessary to raise Dam 3 one foot; the work will cost not to exceed \$3,000. There is no lock house at Lock 10, Zanesville, and to construct one suitable for the site will cost \$5,000. An appropriation of \$8,000 for the purposes stated is recommended.

Report on examination of the river from Zanesville to Coshocton, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$11,367.49
March 13, 1903, received from sale of condemned property	192.07
	11,559.56
February 4, 1903, amount deposited to the credit of the Treasurer of the United States ^a	\$56.52
June 30, 1903, amount expended during fiscal year	107.90
	164.42
July 1, 1903, balance unexpended	11,395.14
July 1, 1903, outstanding liabilities	52.55
	11,342.59
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	8,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix I I 1.)

2. *Operating and care of locks and dams, Muskingum River, Ohio.*—

The original condition and scope of this improvement is described in the Annual Report for 1901, pages 485, 486. The slack-water system comprises 10 locks and dams; the locks have an available length of 163 feet, with a width of 36 feet and a depth over the sills at mean low water of 6 feet except at the lower sills of Locks 1 and 4, where the depths are 3 feet and 5 feet, respectively.

The existing project is the operating and maintaining of Locks and Dams 1 to 10, inclusive, and maintaining the navigable depth and width of channels by dredging. A statement of the amounts and dates of all allotments for this work is given in the report of the district officer.

The amount expended up to the close of the fiscal year ending June 30, 1903, was \$1,436,702.63. An additional sum of \$17,190.44 was expended in building a protection wall at Zanesville and altering certain bridges at Taylorsville and Marietta.

The expenditures during the fiscal year ending June 30, 1903, amounted to \$43,448.89.

The system was in good navigable condition at the close of the year, but many parts are decayed, worn out, and must be renewed.

^aTo the credit of the appropriation for "Improving harbor at Cleveland, Ohio."

The total commerce for the calendar year 1902 was (approximately) 84,632 tons freight, valued approximately at \$4,650,000, and 86,651 passengers; this is an increase of 3,024 tons freight and 9,071 passengers over the calendar year 1901.

(See Appendix I I 2.)

3. *Guyandot River, West Virginia.*—See Annual Report of Chief of Engineers for 1901, pages 489, 490, for description, project, etc.

There had been expended, up to June 30, 1903, \$22,500, with the result of fairly good improvement of navigation over a distance of 119 miles, by the removal of channel obstructions and overhanging timber and by training walls made from rocks removed from shoals.

The stream is little frequented by steamboats, most of the traffic being carried by push boats. The chief use made of the river is for floating timber to market, and this business is of very great importance, not only locally, but to those along the Ohio desiring lumber, and is increasing in amount.

Draft at mean low water, 20 inches.

Commerce: Logs, cross-ties, and staves.

Commercial statistics.

Fiscal year—	Tons.	Calendar year—	Tons.
1891	61, 128	1897	190, 000
1892	103, 800	1898	158, 000
1893	162, 250	1899	110, 000
1894	141, 221	1900	130, 000
1895	247, 400	1901	160, 000
1896	202, 000	1902	160, 000
1897	143, 300		

July 1, 1902, balance unexpended..... \$0. 22
 June 30, 1903, amount expended during fiscal year..... .22

(See Appendix I I 3.)

4. *Big Sandy River and Levisa and Tug forks, West Virginia and Kentucky.*—In its original condition this river and its forks were much obstructed by rocks, bars, snags, and leaning trees. During the low-water period of each year navigation was practically suspended.

The original project, providing for the removal of rocks, snags, and overhanging trees from the main stream and the Levisa and Tug forks, which unite at the town of Louisa, Ky., to form the main stream, was for "improving Big Sandy River, from Catlettsburg, Ky., to the head of navigation," and was adopted in 1878. (Annual Report of the Chief of Engineers for 1875, pp. 756-769.) This improvement was for the purpose of aiding light-draft steamboat, push boat, and rafting navigation on the main river and the Tug and Levisa forks.

In 1880 the appropriations for the forks were made distinct from that for the main river, and three works resulted. At the same time the project of 1878 for the improvement of the Big Sandy proper was so modified as to provide for the construction of a lock and dam in that stream at Louisa immediately below the junction of Levisa and Tug forks. A concurrent resolution of Congress of April 14, 1898, required surveys and the preparation of more complete plans and estimates for the improvement of the Big Sandy and the Tug and Levisa forks of same in Kentucky and West Virginia, with probable cost of same. A report was submitted and is printed as House Document

No. 456, Fifty-fifth Congress, second session, and found on page 2159 of the Annual Report of the Chief of Engineers for 1898.

The river and harbor act of March 3, 1899, adopted a portion of the extended improvement recommended, and authorized the letting of contracts for completion of two locks and dams on the Big Sandy River, between Louisa and the mouth, at a cost not to exceed \$450,000.

The river and harbor act of June 13, 1902, authorized the construction of a lock in each of the forks next above their junction, the completion of the locks and dams in the Big Sandy River, and the raising of the crest of the dam at Louisa. An appropriation of \$175,000 was made, and authority for the expenditure of \$175,000 additional given.

Up to June 30, 1903, the expenditures had aggregated \$658,577.38 with the following result:

Under the project for removing obstructions a good channel had been opened and maintained, and under modified projects (1880 and 1891) a lock and movable dam had been opened to navigation. The survey (act of March 3, 1899) had been made, a lock at the mouth of the river had been virtually completed, and the construction of the movable dam started, and a lock halfway between the mouth and Louisa was nearing completion. The borings necessary to determine upon the sites for the two locks authorized by the act of June 13, 1902, had been completed, and the locations decided upon.

Up to June 30, 1903, \$29,594.97 had been expended on Levisa Fork, and \$29,784.06 on Tug Fork, a total of \$59,379.03, resulting in the material improvement of navigation, giving increased facilities for push boats at low water, and for rafts and steamboats at moderate stages for a distance of about 100 miles on each fork.

The work heretofore done has enabled craft drawing 20 inches to run at mean low water over the shoalest parts of the streams.

The maximum draft which can be carried at mean low water over the shoalest part of the river is 20 inches, and the variation of water surface at Catlettsburg is sometimes as much as 60 feet, and at Louisa as much as 50 feet.

The commerce consists largely of timber, cross-ties, and staves, and varies somewhat with the condition of the rivers, being greatest during wet seasons and least during times of long-continued dry weather. In general it is about 175,000 tons for Levisa and 125,000 tons for Tug, a total of 300,000 tons. The statistics in detail are given in the report of the local officer.

The head of the projected slack-water system is at Pikeville, on Levisa Fork, and at the mouth of Pond Creek on Tug Fork.

A continuation of the improvement of the main river should include regulating works below Dam No. 1.

Commercial statistics.

Fiscal year—	Tons.	Calendar year—	Tons.
1890	268,582	1897	406,900
1891	277,303	1898	415,400
1892	455,926	1899	328,272
1893	466,723	1900	300,000
1894	297,800	1901	349,862
1895	545,910	1902	350,935
1896	471,382		
1897	414,500		

The above is the commerce of the three streams, Big Sandy proper from Louisa, Ky., to its mouth in the Ohio at Catlettsburg, Ky., a distance of 26 miles, and of Levisa and Tug forks, which unite at Louisa to form the main river.

July 1, 1902, balance unexpended.....	\$493,765.62
Amount received from sales.....	1,054.00
Amount appropriated by sundry civil act approved March 3, 1903....	50,000.00
June 30, 1903, amount expended during fiscal year.....	544,819.62
	124,071.15
July 1, 1903, balance unexpended	420,748.47
July 1, 1903, outstanding liabilities.....	1,925.08
July 1, 1903, balance available	418,823.39
July 1, 1903, amount covered by uncompleted contracts.....	180,382.54
{ Amount (estimated) required for completion of existing project.....	4,065,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	a 168,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix I I 4.)

5. *Operating and care of lock and dam on Big Sandy River, West Virginia and Kentucky.*—This lock and dam, located near Louisa, Ky., were finished during the fiscal year of 1897, under appropriations for improving Big Sandy River, West Virginia and Kentucky.

The lock has a depth of 1 foot 9 inches over the lower sill at mean low water and of 11 feet 9 inches over the upper sill at pool level. When the other dams of the series have been built the minimum depth at pool stage will be 6 feet. The lock is 52 feet wide and 190 feet long between hollow quoins. The navigable pass is 130 feet wide.

The project involves operating and care of the lock and dam with such funds as may annually be allotted.

The amount expended for this purpose to June 30, 1903, was \$19,784.33, the work having continued since July 1, 1897.

On June 30, 1902, the work was in good condition and available for commerce.

The expenditures during the fiscal year ending June 30, 1903, were \$4,170.97, and have resulted in keeping the work in excellent navigable condition, the buildings, walks, and grounds in repair, and in the satisfactory operation of the lock and dam.

Commercial statistics for this work are given in the report for improving Big Sandy River.

(See Appendix I I 5.)

6. *Kentucky River, Kentucky.*—At the time the United States assumed control of the Kentucky River the improvement that had been made by the State of Kentucky, which included five locks and fixed dams, was found to be in a dilapidated and almost worthless condition, the pools being filled with snags, and navigation entirely suspended.

^a Of this amount \$125,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

The original project, adopted in 1879 (Annual Report of the Chief of Engineers for 1879, pp. 1398-1422), provided for repairing and rebuilding the five old locks and dams, removing snags, logs, and other obstructions, and extending 6-foot slack-water navigation upstream to Three Forks, a distance of about 261 miles from the mouth of the river in the Ohio, at Carrollton, Ky.

The amount expended to June 30, 1903, was \$2,286,472.23. The result of this expenditure was the repairing and rebuilding of five old locks and dams built by the State of Kentucky; completion of Locks and Dams Nos. 6, 7, and 8, and a dam at Beattyville; the partial completion of Lock and Dam No. 9; completion of lock houses; beginning construction of Lock and Dam No. 10; and on June 27 a contract was entered into for the construction of lock houses at No. 11, and at the close of the year specifications were prepared for the construction of the lock and dam.

The first dam in the series is 4 miles from the Ohio, and during the extreme low water in the latter stream the depth is reduced to about 2½ feet; otherwise the minimum draft is 5.5 feet to Dam No. 9, now under construction, a distance of 158 miles, above which no boats can run at low stage.

There has been no increase in the length of navigable river during the year.

The available length of the old State locks is 146 feet, with 38 feet width. The new locks have an available length of 148 feet and a width of 52 feet.

The cost of the complete improvement will exceed by a large sum the limit of authority granted by existing legislation, as stated in the Annual Report of the Chief of Engineers for 1899, page 2514. This limit of \$1,349,000 will probably be reached while the last three locks and dams are still untouched or incomplete.

The completion of Lock and Dam No. 11 will probably exhaust this limit of authority granted, leaving a possible balance of one-half of the amount necessary to build No. 12.

The commercial statistics will be found in the report upon operating and care of Kentucky River.

July 1, 1902, balance unexpended	\$585, 787. 35
March 6, 1903, received from sale of property	53. 10
Amount appropriated by sundry civil act approved March 3, 1903....	200, 000. 00
	785, 840. 45
June 30, 1903, amount expended during fiscal year	135, 175. 16
July 1, 1903, balance unexpended	650, 665. 29
July 1, 1903, outstanding liabilities	778. 47
July 1, 1903, balance available	649, 886. 82
July 1, 1903, amount covered by uncompleted contracts	255, 031. 09
Amount (estimated) required for completion of existing project.....	1, 935, 000. 00

(See Appendix I I 6.)

7. *Operating and care of locks and dams on Kentucky River, Kentucky.*—The maintenance of these works devolves upon the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation. The total expended to June 30, 1903, was \$1,065,855.64; the amount expended during the fiscal year ending

June 30, 1903, was \$119,355.43. With this sum the locks were operated and the channels maintained in navigable condition. During the year minor repairs were made to the different locks, grounds, and buildings. Extensive repairs were made to the dam at No. 1, and to the lower land and river cribs at Lock No. 2, and to the lower land crib at Lock No. 3, which latter work is not yet completed.

At the close of the year the system was in good navigable condition.

The commerce, in tons of freight, at the different locks for the last four years has been as follows:

Lock.	Calendar year.			
	1899.	1900.	1901.	1902.
No. 1.....	96,651	113,823	122,385	84,472
No. 2.....	83,809	95,353	108,517	57,612
No. 3.....	72,370	90,866	103,761	57,738
No. 4.....	72,983	84,005	92,131	56,671
No. 5.....	83,866	119,711	147,134	95,833
No. 6.....	73,300	113,192	137,345	87,973
No. 7.....	94,379	127,406	135,473	93,101
No. 8.....	.....	8,348	147,062	113,682
Average.....	82,480	106,336	124,226	80,885

(See Appendix I I 7.)

IMPROVEMENT OF FALLS OF THE OHIO RIVER, OF WHITE RIVER, INDIANA, OF WABASH RIVER, INDIANA AND ILLINOIS, AND OF CERTAIN RIVERS IN KENTUCKY.

This district was in the temporary charge of Maj. (now Lieut. Col.) E. H. Ruffner, Corps of Engineers, to October 6, 1902, and in the charge of Maj. George McC. Derby, Corps of Engineers, since that date. Division Engineer, Col. G. J. Lydecker, Corps of Engineers.

1. *Falls of the Ohio River at Louisville, Ky.*—Improvements under this title have included the enlargement of the basin immediately above the locks of the Louisville and Portland Canal, the enlargement of the head of the canal, and straightening, deepening, and controlling the flow of water over the Falls of the Ohio through Indiana Chute.

The original conditions at these localities were as follows: The basin above the locks was only 91 feet wide and quite insufficient for handling the large traffic through the canal. Previous to 1883 the approach to the canal at its upper end above the bridge at Fourteenth street was so narrow as to constitute a source of much expensive delay to the large coal tows which came down the river on ordinary rises. The canal proper, from Ninth to Fourteenth street, was only 100 feet wide, and curved between the two points so that progress was slow and accidents frequent and unavoidable. The greater part of the dike marking the north side of the approach to the canal was submerged when the river reached a stage of 8.4 feet, upper canal gauge, and at stages of 9 feet and above a strong cross current set out from the shore, thus carrying many vessels against the dike and at high enough stages over it onto the rock ledges beyond. This approach was 1,800 feet long and varied in width from 400 feet at the upper end to 100 feet opposite Ninth street. Its area was wholly insufficient for breaking and rearranging tows preparatory to entering or leaving the canal.

Indiana Chute is the main channel of the river, by which commerce passes over the Falls when the stage of water will permit. Originally

it was very crooked, with swift currents and whirlpools filled with dangerous rocky points projecting from the sides and bottom, and it could be navigated only at stages of 11 feet or more, upper canal gauge; even at such stages the services of special skilled pilots were necessary.

The original project related only to the enlargement of the head of the Louisville and Portland Canal and was adopted in 1883. It proposed straightening and widening the canal proper, from the cross dam to a point a short distance below the railroad bridge at Fourteenth street, so as to provide ample space for the necessary rearrangement of tows about to enter or leave the canal. This was slightly modified in 1885. A revision of the project was made by a Board of Engineer officers, and approved January 31, 1890. This revision modified the area to be excavated, and determined the number and kind of structures, etc., to be built. It provided for enlarging the canal on its northerly side, from a point 725 feet below the railroad bridge at Fourteenth street, from 90 feet to 210 feet: this latter width is then gradually increased, through a distance of nearly 2,800 feet, to 325 feet at the head of the canal proper, at which point the enlargement is expanded into a capacious basin or harbor 1,200 feet wide and practically parallel to the Kentucky shore.

The structures proposed were a new retaining wall on the north side of the canal, a movable dam about 800 feet long, a fixed dam extending from the movable dam at the westerly end of the basin to the south abutment of the movable dam in the middle chute. The excavation of rock within certain limits to the same grade as the canal bottom, the construction of certain walls and revetments on the south side of the canal, and the removal of the old structures within the limits of the enlargement were also included in the project. Under date of April 9, 1899, a further modification of some of the details of the project was approved.

Prior to 1890 there was no general project for the systematic improvement of the Indiana Chute, although much work had been done on it under allotments from appropriations for improving Ohio River. On January 31, 1890, the project of a Board of Engineer officers for the improvement of this chute was approved. This project had for its object the widening and deepening of the channel by rock excavation and the control of water flow in the channel by means of dikes, etc., so as to make this route available for descending tows of coal barges drawing $6\frac{1}{2}$ feet at stages of 8 feet, upper canal gauge. Only a part of the work necessary for the purpose in view was included in the estimate accompanying the report of the Board, some important details being deferred for future consideration. A consolidation of the projects for the enlargement at the head of the canal and the improvement of the Indiana Chute was authorized June 28, 1897, and since that time funds have been provided for work at both localities under one title of appropriation.

On December 30, 1901, the Chief of Engineers approved a report of a Board of Engineer officers, submitting plans and estimates amounting to \$466,180, covering the portion of the project deferred for future consideration by the Board of 1890. These plans for the completion of the upper end of the Indiana Chute channel contemplate producing a depth of 8 feet through that part of the chute by substituting a movable dam for the present fixed dam and the construction of certain

submerged dikes and cross dams. No appropriation has yet been made for this part of the work. The amount expended on original and modified projects to June 30, 1902, is \$1,513,881.45.

The existing project for the improvement is the original, with the modifications mentioned in the preceding paragraph. The estimated cost is \$2,125,819.79. The amount expended on work of existing project since June 30, 1902, up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$21,406.09.

The results derived from the expenditures to date, for work so far completed, have been of marked advantage to traffic and greatly facilitate its movement. The enlargement of the basin above the locks was completed in 1893. At the head of the canal the work of enlargement has been entirely completed from a point 725 feet below the Fourteenth street railroad bridge to a point 2,800 feet above that bridge. Beyond this point, in the basin east of the north canal wall, the excavation to grade within the prescribed limits is about 96 per cent completed, a width of 415 feet being at this date available.

In the Indiana Chute, above the Fourteenth Street Bridge, the channel width has been increased from 200 feet to 400 feet and all rock within these limits excavated to the grade prescribed in the project; at Wave rock and Willow Point all excavation and the dikes have been completed. The depth of water over Wave rock and Willow Point approximates very closely the depth expected, i. e., 8 feet, when there is 8 feet on the upper canal gauge. The depth in the upper portion of the chute is still unsatisfactory.

The chute can now be navigated with ease by heavy-draft coal boats at stages of 11.5 feet, upper canal gauge. Coal barges drawing 6.5 feet can use this channel at 9.5-foot stage.

Commercial statistics are embodied in the following report for operating and care of Louisville and Portland Canal, and a comparative statement of same will be found in Appendix J J 2 of this report.

More extended information may be found in Annual Reports, Chief of Engineers, United States Army, as follows: 1882, page 1881, special report; 1883, page 1539, with map, etc.; 1885, page 1795, with sketch; 1886, page 1572, with maps; 1887, page 1838; 1890, page 2217, report and estimate of Board of Engineer officers; 1892, page 2015, with maps; 1893, page 2543, with maps; 1895, page 2427, with maps; 1897, page 2442; 1898, page 1951, with maps, etc.; 1899, page 2545, with maps, etc., and report and estimate of Board of Engineer officers; 1900, page 3463, with views of works; 1902, page 1961, with maps, etc., and report of Board of Engineer officers.

Miscellaneous reports.—Report of Capt. T. J. Cram, February 3, 1844, Senate Executive Document No. 243, Twenty-eighth Congress, first session.

Report and estimate relative to ship canal around the Falls of Ohio River, House Executive Document No. 181, Fortieth Congress, second session; also found in Annual Report, Chief of Engineers, United States Army, 1868, page 528.

Special report as to additional works needed, etc., with maps, Senate Executive Document No. 129, Forty-seventh Congress, first session. The report, without maps, may be found in Annual Report, Chief of Engineers, United States Army, 1882, page 1880.

It is expected that report on the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$54,368.55
June 30, 1903, amount expended during fiscal year.....	21,406.09
July 1, 1903, balance unexpended	32,962.46
July 1, 1903, outstanding liabilities.....	2,347.07
July 1, 1903, balance available	30,615.39
{ Amount (estimated) required for completion of existing project.....	557,569.79
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	250,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix J J 1.)	

2. *Operating and care of Louisville and Portland Canal.*—This canal was constructed by a private corporation, acting under a charter granted by the Kentucky legislature in 1825. It was completed in 1830. At that time the canal was about $2\frac{1}{2}$ miles long, and there was a flight of three locks, each with a lift of $8\frac{2}{3}$ feet, 200 feet long and 50 feet wide.

The width of the canal was from 64 to 68 feet at the normal water line, and afforded a depth of nearly 3 feet at extreme low stages of the river. There was no dam at the head of the canal. The United States became a stockholder in the corporation in 1826, and gradually increased its holdings until all of the outstanding stock and bonds had passed into its possession.

In 1860 an enlargement and extension, which included new locks, of the canal was begun under the corporate management, and resulted in the width of the canal being increased to 90 feet, with three basins or passing places, and the construction of a new flight of two locks with a total lift of about 26 feet, each lock being 350 feet long and 80 feet wide. The new locks were completed in 1872. The United States assumed charge of the work of enlargement of the canal and construction of a dam at its head subsequent to an allotment for that purpose in 1868, but the operation of the canal and collection of toll remained under control of the canal company until June 10, 1874, when it was transferred to the United States pursuant to the act of Congress of May 11, 1874, which act provided that the canal should be held "free of all tolls and charges except such as are necessary to pay the current expenses of said canal and keep same in repair." Tolls were entirely abolished after July 1, 1880, and since that date the expenses of operation and maintenance of the canal have been borne directly by funds made available by the act of March 3, 1881, and the act of July 5, 1884.

The general project for operation and care of the canal contemplates the operation of the locks, dredging to keep the canal clear of deposits brought into it by high water, and maintaining the canal and its appurtenances in good serviceable condition.

The amount expended since 1874 on the original and subsequent annual projects prior to June 30, 1902, is \$2,091,191.55.

The existing project and estimate for the operation and care of the canal during the fiscal year 1903, under the provisions of the act of July 5, 1884, was approved by the Secretary of War July 30, 1902. It included items of repair work for the canal dry dock, a new blacksmith shop, new carpenter shop, new boilers for dredges 1 and 2, repairing towboat, rebuilding wall at Ninth Street Basin, removing pro-

jecting rock under Fourteenth Street Bridge, and removal of disrupted rock from lower entrance to the locks, and the usual items for ordinary current repairs, supplies, operation, and supervision. The estimate amounted to \$134,033.93.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$85,937.58.

The canal is available to commerce at all stages of the river less than 12.7 feet, upper canal gauge, and affords free navigation around the Falls of the Ohio River at stages of water when the passage can not be made by the open river channel. At the lowest stage of water on record the maximum draft that can be carried through the canal is 2.7 feet, but in average low-water seasons it is not less than 3.8 feet. The water level varies from the above figures to 13.7 feet above the shoalest part of the canal, at which latter height the lock walls are submerged and safe navigation is possible over the Falls. The canal is an essential factor in the through navigation of the Ohio River and many of its tributaries at low and medium stages.

During the fiscal year ending June 30, 1903, 5,079 boats, barges, and small craft passed through the canal, carrying 992,898 tons of freight and 13,440 passengers. During the same period 2,643 boats, barges, and small craft passed the Falls via the open river channel, carrying 1,043,529 tons of freight.

For comparative statement of traffic and commerce see Appendix J J 2 of this report.

More extended information concerning the operation and care of this canal may be found in Annual Reports of the Chief of Engineers, United States Army, as follows: 1876, page 748; 1877, page 607; 1878, page 772, with sketches showing canal before enlargement, condition of canal when United States took charge of work in 1868, condition in 1878, and 7 plates showing elevations, sections, gates, well holes, references, etc., of new locks; 1879, page 1284; 1880, page 1724; 1881, page 1904; 1882, page 1903; 1883, page 1533; 1884, page 1693; 1885, page 1692; 1886, page 1574; 1887, page 1843; 1888, page 1728; 1889, page 1920; 1890, page 2221; 1891, page 2394; 1892, page 2024; 1893, page 2554; 1894, page 1935; 1895, page 2434; 1896, page 2226; 1897, page 2444; 1898, page 1957, with two sheets of drawings of combined dredge and derrick boat; 1899, page 2565, accompanied by four photographic views of the automatic gate built in the chamber of old locks, and sketch showing clearance under drawspan of Fourteenth street railroad bridge; 1900, page 3482; 1901, page 2791; 1902, page 1976.

Special reports: Report of W. D. Gallagher, special agent, Treasury Department, September 30, 1867, concerning interest of the United States in the Louisville and Portland Canal, legislation, financial affairs, conditions, etc. House Miscellaneous Document No. 83, Fortieth Congress, second session.

Report of Board of Engineer officers, December 19, 1871, concerning failure of miter sills of the new locks of the Louisville and Portland Canal. Page 460, Annual Report Chief of Engineers, United States Army, 1872.

Report of Maj. G. Weitzel, Corps of Engineers, United States Army, January 9, 1872, concerning failure of miter sills of the new locks of the Louisville and Portland Canal. Page 452, Annual Report Chief of Engineers, United States Army, 1872.

Special Orders, No. 117, War Department, Adjutant-General's Office, Washington, May 27, 1874, appointing Maj. Godfrey Weitzel, Corps of Engineers, to confer with president and directors of the Louisville and Portland Canal Company with a view to making arrangements for receiving and taking possession of the canal and all the property, under the provisions of act of Congress approved May 11, 1874. Page 777, Annual Report Chief of Engineers, United States Army, 1875.

Report of the House Committee on Railways and Canals, recommending that the Louisville and Portland Canal be made free from toll. House Report No. 348, Forty-sixth Congress, second session.

Report on drainage rights, Louisville and Portland Canal, by Maj. Amos Stickney, Corps of Engineers, United States Army, June 29, 1886, accompanied by map showing location of sewers emptying into the canal, and copies of laws and reports relating to drainage into the canal. House Executive Document No. 51, Forty-ninth Congress, second session. The report, with map omitted, may be found on page 1852, Annual Report, Chief of Engineers United States Army, 1887.

Laws: State and national laws relating to the Louisville and Portland Canal. Page 1540, Annual Report Chief of Engineers United States Army, 1883.

(See Appendix J J 2.)

3. *Wabash River, Indiana and Illinois.*—In its original condition this river was badly obstructed by rocky reefs, bars, and accumulations of snags. These obstructions, together with the effects of numerous secondary channels or cut-offs, which reduced the flow of water in the main channel, rendered navigation at normal stages impracticable. A lock and dam had been built at Grand Rapids and a few improvements made at other places by private enterprise, but as none of them was of a substantial character they rapidly deteriorated and were useless when the United States began the work of improving the river in 1872.

The original project and scope of improvement is found in the report of Maj. G. Weitzel, Corps of Engineers, dated January 4, 1872. The improvement of the river from its mouth to Lafayette, Ind., was proposed. Special work at twelve designated places was estimated for in addition to the general work of dredging and snagging. The estimate amounted to \$312,672.62. Subsequently work at other places than those mentioned in the project was added from time to time, but no general revision of the project and estimate was made. The river and harbor act of March 3, 1881, made separate appropriations for "Work Above Vincennes" and "Work Below Vincennes," and since that date funds have been provided and reports made separately for these two sections of the river. Expenditures to March, 1881, amounted to \$324,845.44; those for work under the separate appropriations since that date are given under the respective headings, as follows:

(a) *Below Vincennes.*—Subsequent to 1881 work was continued under the original project, but the estimates were increased from time to time. Special provision for levee work at Grayville was made by Congress in 1886; in 1898 a plan with estimate amounting to \$50,000 for additional work at New Harmony Cut-off was approved. It had been frequently urged that if the improvement of the river was to be continued the general project, being inadequate for present conditions, should be abrogated and a new one formulated based upon information furnished by a comprehensive survey and designed to meet the present and pro-

spective requirements of commerce. The act of June 13, 1902, appropriated \$5,000 for improvement, but authorized its expenditure and the balances from previous appropriations in making a survey and estimate of cost of improving Wabash River, below Vincennes, with a view to the necessities of commerce. It is expected that report of this survey will be submitted to Congress in December, 1903.

The aggregate of the original and subsequent estimates constituting the estimate of cost of existing project amounts to \$425,000. The expenditures on the work of existing project, i. e., since March, 1881, up to the close of the fiscal year ending June 30, 1903, amounted to \$374,287.79.

Previous to 1885 a fairly good channel for boats having a draft not exceeding 2½ to 3 feet was maintained, but the river and harbor act of July 5, 1884, having made specific appropriation for a lock at Grand Rapids, near Mount Carmel, Ill., after that date the funds available were applied toward the completion of the lock, dam, and appurtenant structures, thus necessitating the suspension of operations elsewhere, for the reason that the appropriations since the beginning of the lock have not been sufficient for that purpose and the maintenance of channels formerly available which have rapidly deteriorated.

Through navigation at low water is now impracticable. Boats drawing 20 inches can pass from Mount Carmel to Vincennes, a distance of 32 miles, at all stages, but can only reach Mount Carmel, 91 miles from the mouth, when the gauge at the lock reads 7.5 feet or more.

Commercial statistics will be found in the report for "Operating and care of lock and dam at Grand Rapids, Wabash River." (Appendix J J 4.)

More extended information concerning the improvement of this river may be found in Annual Reports of the Chief of Engineers, as follows: 1871, page 485, report on preliminary survey with recommendation for further survey; 1872, page 472, report on survey with recommendation for improvement, which report constitutes the original project; 1873, page 510, abstracts of the charter of the Wabash Navigation Company, original estimates and legal rights of the company, statement as to condition of its lock, dam, and other property at Grand Rapids; 1877, page 667; 1879, page 1440, with drawings and maps; 1881, page 1995; 1885, page 1638; 1886, page 1582, "Amount (estimated) required for completion" increased to \$310,000; 1888, page 1738; 1889, page 1928; 1895, page 2441, detailed statement of original estimate and expenditures; 1896, page 2239, with drawing showing fishways; 1898, page 1970, review of work under original project, resurvey of New Harmony Cut-off, map, statement concerning necessity for a correct and comprehensive survey, and revision of the project.

July 1, 1902, balance unexpended	\$20,346.39
June 30, 1903, amount expended during fiscal year	4,479.62

July 1, 1903, balance unexpended	15,866.77
July 1, 1903, outstanding liabilities	1,355.73

July 1, 1903, balance available	14,511.04
---------------------------------------	-----------

{ Amount (estimated) required for completion of existing project	^a 40,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	(b)

^a This amount is the unappropriated balance of former estimate for work at New Harmony Cut-off.

^b No estimate is submitted pending results of survey now in progress.

(b) *Above Vincennes.* At the time this section of the river became the object of separate appropriations there had been no revision of the estimate in the original project for the improvement of the river from its mouth to Lafayette, and the amount appropriated in the act of March 3, 1881, was in excess of the items in that project applicable to this part of the river. From time to time new work was undertaken, and the estimates to June 30, 1903, amounted to \$95,500.

The expenditures on the work of existing project up to the close of the fiscal year ending June 30, 1903, amounted to \$95,238.42.

The funds available during the past fifteen years have not been sufficient to maintain the works for channel rectification and control of water flow and to keep the river clear of snags and similar obstructions. No permanent improvement of this section of the river has been effected, and navigation is practicable only at high stages of water.

The only commercial statistics available are those collected at the lock at Grand Rapids.

More extended information may be found in Annual Reports of the Chief of Engineers, as follows: 1881, page 2001; 1882, page 1582; 1883, page 1761, which also includes table of distances, Terre Haute to Mount Carmel, Ill., with elevations at low water above the level of the sea on Wabash River.

Reports on examinations may be found as follows: Annual Reports Chief of Engineers, 1885, page 1649, Logansport to Delphi; 1890, page 2411, Terre Haute to Lafayette, which report is also printed in House Executive Document No. 65, Fifty-first Congress, second session.

It is expected that report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$566.35
June 30, 1903, amount expended during fiscal year	304.77

July 1, 1903, balance unexpended	261.58
--	--------

(See Appendix J J 3.)

4. *Operating and care of lock and dam at Grand Rapids, Wabash River.*—This lock and dam was built from funds derived from appropriations for improving Wabash River, Indiana and Illinois, and opened to navigation in November, 1893. The available length of the lock is 214 feet; width, 52 feet; depth on lower miter sill at low water, 3.5 feet; depth on upper miter sill at normal pool stage, 5.08 feet. At such stages the pool above the lock affords slack-water navigation about 12 miles and the maximum draft that can be carried is about 2 feet. Conditions beyond the pool are mentioned in the report for improving Wabash River, Indiana and Illinois.

The expenses of operating the lock were paid from the appropriations for improvement of the river until March 1, 1897, since which date they have been paid from annual allotments from the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884.

The first and subsequent annual projects proposed the operation of the lock and the maintenance of it and the appurtenant structures in good serviceable condition. The expenditures under these projects to June 30, 1902, amounted to \$21,372.05.

The project for the fiscal year 1903 provided for the operation of the lock, removal of deposit from the lock and approaches thereto, and minor repairs to the fences, buildings, etc., on the Government grounds, at an estimated cost of \$5,450, which amount was made available by allotment July 29, 1902. The amount expended during the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$2,119.52.

During the past fiscal year 297 boats, barges, etc., and 10,040 tons of freight, passed the lock. A comparative statement of traffic and commerce passing this lock during the past seven years will be found in Appendix J J 4 of this report.

(See Appendix J J 4.)

5. *White River, Indiana*.—Originally this tributary to Wabash River was badly obstructed by rocky reefs, remains of old structures, and a very great number of snags. It could be navigated only at high stages of water.

The original project is based upon the report of "examination of White River and its forks in Indiana," submitted December 31, 1878. The first appropriation for improvement was made in the act of March 3, 1879. In this act the work of improvement was limited to "White River, Indiana, from Wabash River to Portersville, and to the falls on the west fork, according to report of the Chief of Engineers, without constructing locks and dams." A minimum depth of 2 feet at low water was sought. In 1886 the estimate was reduced. The river and harbor act of August 18, 1894, provided for a resurvey of the river.

Subject to the modifications mentioned, the original project constitutes the existing project of this date. The estimate of cost is \$120,000. The amount expended to June 30, 1903, not including outstanding liabilities, is \$119,296.18.

As a result of these expenditures the lower 13 miles of the river is navigable all the year for boats having a draft not exceeding 3 feet; above this to the junction of the two forks boats drawing 18 inches can navigate for about six months of the year. Low-water navigation on the forks is impracticable even for the smallest boats. This information is derived from the report on the resurvey made in 1895-96, since which date operations have been suspended, the funds available not being sufficient for either work of improvement or maintenance of former structures for controlling the flow of water and bank protection, or to keep the channel clear of snags.

No statistics as to the volume or character of commerce moved on this river during the past year are available.

The report upon the resurvey of the river, House Document No. 47, Fifty-fourth Congress, second session, also Annual Report Chief of Engineers, 1897, page 2483, contains data concerning the volume and character of commerce that would be benefited by, or involved in, the further improvement of the river. This report also contains estimates of cost of improvement under alternative plans and recommendation that "the further improvement of the White River should be postponed until the improvement of the Wabash has been so improved as to afford an outlet for any traffic which may then be developed on White River."

More extended information concerning this river may be found in Annual Reports Chief of Engineers, as follows: 1880, page 1842, with map of Kellys Ripple; 1896, page 2244; 1897, page 2483.

July 1, 1902, balance unexpended.....	\$703.82
July 1, 1903, balance unexpended.....	703.82

(See Appendix J J 5.)

6. *Green River above the mouth of Big Barren River, Kentucky.*—In its original condition this part of Green River was much obstructed by snags, large bowlders, and overhanging trees. Dam No. 4, Green River, afforded slack water for about 18 miles above the confluence of Green and Barren rivers. The fall in that part of the river above slack water and below Mammoth Cave, Ky., was approximately 27 feet.

The original project is that submitted under date of August 11, 1891 (printed in Annual Report of the Chief of Engineers for 1891, p. 2481). It proposes the extension of slack-water navigation from the upper limits of Pool No. 4 to Mammoth Cave, by the construction of two locks and dams, at an estimated cost of \$361,346.40 for both. No revision of the project has been made. The amount expended to June 30, 1903, not including outstanding liabilities, is \$180,059.60.

As a result of these expenditures one of the locks and dams, No. 5, has been completed and opened to navigation, thus extending slack water to a short distance above Brownsville, the county seat of Edmonson County, Ky., and through a part of the rich mineral district bordering the river which heretofore had no conveniently accessible transportation route. The site for the second lock, No. 6, has been decided upon, but the purchase of the land is not yet completed on account of condemnation proceedings being necessary to perfect the title.

Commercial statistics are given in the report for operating and care of locks and dams on Green and Barren rivers, Kentucky. (Appendix J J 7.)

More extended information concerning the improvement of this part of the river may be found in Annual Reports of the Chief of Engineers, as follows: 1880, page 1802; 1891, page 2478; 1895, page 2473; 1897, page 2459; 1898, page 1985; 1900, page 3501.

July 1, 1902, balance unexpended.....	\$181,019.61
June 30, 1903, amount expended during fiscal year.....	406.01

July 1, 1903, balance unexpended.....	180,613.60
July 1, 1903, outstanding liabilities.....	94.74

July 1, 1903, balance available.....	180,518.86
--------------------------------------	------------

(See Appendix J J 6.)

7. *Operating and care of locks and dams on Green and Barren rivers, Kentucky.*—The former system of slack-water navigation, comprising four locks in Green River, one lock in Barren River, and a total length of pools of approximately 200 miles, was completed by the State of Kentucky in 1841. The State retained control of the system until 1868, when it was leased to the Green and Barren River Navigation Company for a term of thirty years. The United States purchased the unexpired part of this lease and assumed possession of the system and all property and privileges pertaining thereto December 11, 1888. The conditions existing at that time were as follows: The walls of Lock No. 2 were cracked and in bad condition generally, the land wall especially so, it being held in position by anchorage to cribs filled with stone; the river wall had yielded outward. Lock No. 3 was broken entirely, the river wall having yielded outward and fallen into

the river. The walls of Lock No. 1, Barren River, were so badly cracked that one of them, the land wall, inclined toward the lock pit and was liable to fail at any time. The entrances to the locks were obstructed with deposit and the pools with great numbers of snags, overhanging trees, etc.; the appurtenant structures at the locks and the locktenders' dwellings were in bad condition and inadequate.

The original project, approved January 4, 1889, proposed the restoration, so far as practicable, of the former structures to good serviceable condition, the construction of new ones where required, the removal of obstructions from the pools and lock entrances, the operation of the locks and maintenance of the whole system in good navigable condition, with funds provided annually by allotment by the Secretary of War, from the act of July 5, 1884. The amount expended since January, 1889, on the original and subsequent annual projects to June 30, 1902, is \$962,866.21. The existing project and estimate for the operation of the locks and care of the improvements in the rivers during the fiscal year 1903 was approved by the Secretary of War July 30, 1902. It included items of repair work to Dam No. 1, Green River; new office and warehouse buildings at Locks 2 and 3, Green River, and Lock No. 1, Barren River; removal of a part of the lower shore crib at Lock No. 3, Green River, and the ordinary current expenses incident to supervision, operation, and maintenance. The estimate amounted to \$131,430. The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$50,281.49.

The result of the expenditures is the thorough repair of the several locks, appurtenant structures, etc., and the restoration of through navigation in the pools from Lock No. 1, Green River, to Bowling Green, Ky., a distance of 172 miles, for boats not exceeding 35 feet in width, 138 feet in length, and 5 feet draft. At extreme low water there is a depth of only 1 foot on the lower miter sill at Lock No. 1, Green River, 8 miles above its mouth. The system now includes six locks and dams, Lock No. 5 having been built from funds provided by specific appropriations therefor and opened to navigation January 17, 1900.

Following is a synopsis of traffic and commerce through the locks during the fiscal year 1903:

		Boats.	Freight.
GREEN RIVER.		Number.	Tons.
Lock No. 1		3, 246	457, 386
Lock No. 2		2, 663	269, 142
Lock No. 3		1, 935	165, 746
Lock No. 4		2, 172	106, 119
Lock No. 5		1, 125	59, 525
BARREN RIVER.			
Lock No. 1		1, 852	48, 738

A comparative statement of the traffic and commerce on these rivers during the past fifteen years will be found in Appendix J J 7 of this report, from which it will be seen that the commerce of the past year exceeds that of any previous year in the history of the river.

More extended information may be found in Annual Reports of the Chief of Engineers, as follows: 1885, page 1904; 1887, page 1903; 1889, page 1965; 1890, page 2255; 1896, page 2272.

(See Appendix J J 7.)

8. *Rough River, Kentucky.*—Originally this river was very much obstructed by snags, sunken saw logs, stumps, bowlders, and bars in the bed of the stream and by overhanging trees on its banks. Back-water from Dam No. 2, Green River, affected 8 miles of the river above its confluence with Green River, the width varied from about 100 to 200 feet (Annual Report of the Chief of Engineers, United States Army, 1885, p. 1893), and the movement of commerce was limited to periods of high water.

The work of improvement under the original project, dated January 27, 1885, adopted by Congress September 19, 1890, has for its object the extension of slack-water navigation to Hartford Ky., by the construction of a lock and dam and clearing the stream of snags, overhanging trees, and other obstructions. This project was subsequently revised August 31, 1891, in the items of the estimate, dimensions of lock and dam, and the number and kind of other structures necessary in connection with the lock. A further modification in 1895 substituted concrete for stone in the construction of the lock and provided for minor changes in the dimensions previously proposed.

The existing project for improvement is the same as that outlined in the preceding paragraph, the revised estimate approved August 31, 1891, amounting to \$105,556.05.

Expenditures under the existing project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, amounted to \$103,175.11, of which amount approximately \$2,000 was for maintaining the river in good condition since the completion of the lock.

The lock, dam, and appurtenant structures have been completed. The lock was opened to navigation December 12, 1896. The maximum draft that can be carried at the upper end of the pool above the lock at normal pool stage is about 4 feet, the depth on the upper miter sill of the lock at such stage being 6.8 feet. The available length of the lock is 123 feet and available width 27 feet. At low water the head of navigation is a short distance above Hartford, Ky., or about 29½ miles above the mouth of the river and 21¼ miles above the lock. Beyond this navigation is practicable only at high stages of the river and consists principally of rafts and rowboats.

Commercial statistics of the river are given in the report for "Operating and care of lock and dam on Rough River, Kentucky." (Appendix J J 9.)

More extended information concerning the improvement of this river may be found in Annual Reports of the Chief of Engineers, United States Army, for fiscal years as follows: 1880, page 1814; 1891, page 2446; 1892, page 2081; 1893, page 2616; 1894, page 1978; 1895, page 2481; 1896, page 2280, with drawing showing general plan and sections of locks and framing for concrete forms; 1897, page 2471; 1899, page 2599.

The report on examination and survey, with original estimates and State laws, will be found on page 1893, Annual Report of the Chief of Engineers for 1885.

July 1, 1902, balance unexpended	\$3, 195. 19
June 30, 1903, amount expended during fiscal year	870. 30
July 1, 1903, balance unexpended	2, 324. 89
July 1, 1903, outstanding liabilities	17. 27
July 1, 1903, balance available	2, 307. 62

(See Appendix J J 8.)

9. *Operating and care of lock and dam on Rough River, Kentucky.*—This lock and dam was built from funds provided in appropriations for improving Rough River, Kentucky, and opened to navigation December 12, 1896. The lock has an available length of 123 feet, width 27 feet, and depth on upper miter sill at normal pool stage of 6.8 feet. At such stage the pool above the lock affords slack-water navigation 21½ miles, or to a short distance above Hartford, Ky., for boats with draft not exceeding 4 feet.

The expense of operating the lock was paid from the appropriation for improvement until June 30, 1897; since that date the expenses of operating, care, etc., have been borne by the indefinite appropriation for "Operating and care of canals and other works of navigation," act of July 5, 1884.

The project for the fiscal year 1903 proposed to operate the lock and maintain existing structures in good serviceable condition, at an estimated cost of \$1,300, which amount was made available by allotment August 5, 1902.

The amount expended since July 1, 1897, to June 30, 1903, not including outstanding liabilities, is \$5,902.76.

Traffic through the lock during the past fiscal year included 572 boats of various kinds, carrying 32,919 tons of freight.

A comparative statement of traffic and commerce on this river during the past thirteen years will be found in Appendix J J 9 of this report.

(See Appendix J J 9.)

LAKE RIVERS AND HARBORS.

IMPROVEMENT OF RIVERS AND HARBORS ON LAKE SUPERIOR.

This district was in the charge of Capt. D. D. Gaillard, Corps of Engineers, to May 1, 1903, and in the temporary charge of Maj. Lansing H. Beach, Corps of Engineers, since that date. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. *Harbor at Grand Marais, Minn.*—This harbor is an elliptical bay, whose major axis is about one-half mile and whose minor axis is about one-fourth of a mile in length. It has an opening on the south side which was originally about 1,000 feet in width. Before improvement there was a maximum depth of 14 feet over a very limited area, the general average depth being only 8 or 9 feet. It is the only harbor of refuge on the north shore between Agate Bay and the international boundary line.

The approved project of April, 1879, is to build two breakwater piers, each 350 feet long, from the east and west points of the bay, or one pier 700 feet long from the east point, and dredge an anchorage area of about 26 acres to a depth of at least 16 feet, all at an estimated cost of \$139,669.40, but for reasons explained in the report of the local officer (Annual Report of the Chief of Engineers for 1898, p. 2217) this was increased to \$163,954.63.

Two breakwaters, each 350 feet long, have been constructed from the east and west points of the bay, the work being completed on August 13, 1901.

The amount expended on the project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, was

\$163,293.93, of which about \$2,200 was for maintenance. The work done has resulted in a more protected harbor and a 16-foot anchorage area of about 26 acres.

The minimum mean low-water depth June 30, 1903, over the shoalest part of the locality under improvement was 15 feet.

The usual variations of water level extend from about 0 to +1 foot above low-water datum.

The commerce of the port has increased from 25 entrances and clearances, made by 4 tugs and 5 schooners, with 60 tons of cargo, valued at \$6,000, in 1878, to 870 clearances and entrances, nearly all steamers, with 24,233 tons of cargo, valued at \$338,975, in 1902.

The value of the commerce of the harbor from 1878 to 1902, both inclusive, is estimated at \$3,065,839.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended.....	\$2, 260. 82
June 30, 1903, amount expended during fiscal year.....	204. 75

July 1, 1903, balance unexpended.....	2, 056. 07
---------------------------------------	------------

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	2, 000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 1.)

2. *Harbor at Agate Bay, Minnesota.*—This important harbor, situated on the north shore of Lake Superior, 27 miles northeast of Duluth, Minn., is a shipping port for iron ore and lumber and a harbor of refuge.

Before improvement there was ample depth for navigation, but the harbor was exposed to storms from the southwest and to reverse swells from severe northeast storms.

The approved project of January 4, 1887, was to construct two breakwater piers on a line toward each other from the eastern and western points of the bay to be 1,000 and 900 feet long, respectively, leaving an opening of 1,340 feet between their extremities and inclosing an area of 109 acres.

By letter of the Chief of Engineers, March 23, 1899, the total ultimate length of the easterly breakwater was increased by 50 feet.

The original estimate of cost was \$213,000, which was increased to \$244,208 in Annual Report of 1887 on account of higher prices.

The amount expended on the approved project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, was \$244,158.06, of which about \$10,000 was applied to the maintenance of the improvement.

The project was completed on November 1, 1901, and fulfills very effectually the purpose for which it was designed.

The depth at the entrance is over 50 feet, and vessels drawing 20 feet can reach the ore piers in safety.

The usual variation of water level extends from about 0 to about +1 foot above low-water datum.

The vessel freight of this harbor has increased from 236,000 tons of 2,240 pounds, valued at \$524,800, in 1885, to 6,563,456 tons of 2,000 pounds, valued at \$15,789,960, in 1902.

The total valuation of the commerce of this port for eighteen years, 1885 to 1902, inclusive, is estimated at \$79,145,978.

July 1, 1902, balance unexpended	\$2, 185. 01
June 30, 1903, amount expended during fiscal year	135. 07

July 1, 1903, balance unexpended	2, 049. 94
--	------------

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2, 000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	(See Appendix K K 2.)	

3. *Harbor at Duluth, Minn., and Superior, Wis.*—Previous to the Annual Report of 1897 this harbor was reported on under the separate heads of Duluth, Minn., and Superior, Wis., respectively.

The act of June 3, 1896, unified these harbors under the above title and provided for continuous contracts for its improvement to the amount of \$3,080,553.

This harbor consists of the Duluth Canal, the Wisconsin Entrance, Superior Bay, Allouez Bay, St. Louis Bay, and St. Louis River to the limits of the cities of Duluth and Superior, about 20 miles from the original natural entry, which before improvement was obstructed by shifting bars, with but 9 feet of water over them. The bays were broad expanses of shallow water, averaging only 8 or 9 feet, except along the channel through them, where the depth was greater, but variable.

The project adopted by the act of March 3, 1881, previous to the present one, was for 16-foot navigation. This was practically completed July 1, 1897, and resulted in giving a good 16-foot navigation through the natural or Wisconsin Entry, through the artificial Duluth Canal; over the Duluth Basin of 104 acres; along and parallel to the dock lines of Duluth and Superior, in Superior and St. Louis bays, and up the St. Louis River to New Duluth, near the head of navigation of the river, with well-defined channels of from 85 to 300 feet in width.

The present project, authorized by the act of June 3, 1896, and by the modifications of August 14, 1896, and May 9, 1901, provides for the widening and deepening to a navigable depth of 20 feet of the existing channels, for new channels in Allouez Bay and St. Louis River, for extensive turning and anchorage basins of a navigable depth of 20 feet at the junctions of two or more channels, for widening the Duluth Canal, and for rebuilding the piers at the Duluth Canal and Wisconsin Entry and finishing them off with concrete superstructures built of monolithic blocks.

The estimated cost of the work was \$3,130,553, but this referred only to the deepening of the channels and basins by dredging. This has been done at much less than the estimated cost, permitting the purchase of lands to the extent of \$106,561.19, the rebuilding of the Duluth Canal piers at a cost of over \$650,000, including price of land, and leaving a balance of about \$275,000 toward the rebuilding of the piers at the Wisconsin Entry now under construction.

The amount expended on the existing project to the close of the fiscal year ending June 30, 1903, exclusive of outstanding liabilities, was \$2,914,285.29, of which \$225,000 was expended for maintenance.

The work done up to the close of the past fiscal year has been as follows:

The two contracts for dredging the channels and basins, which were in operation for six seasons, have been completed, and 21,697,243 cubic yards of material has been removed.

All the land necessary for the widening of the Duluth Canal has been acquired by deed of gift, purchase, or condemnation, at a cost of \$53,919.05.

The land needed for improvement at the Wisconsin Entry, the mouth of the Nemadji River, and on a marshy island in the St. Louis River, was obtained by condemnation proceedings at a cost of \$42,795.94.

A small parcel of land at the end of Grassy Point and certain lands in Spirit Lake were purchased at a cost of \$3,146.20.

A site for a boat yard on Minnesota Point, near the Duluth Canal, has been purchased at a cost of \$6,700.

Both piers of the Duluth Canal have been completed and equipped with lamp-posts.

The lake, harbor, and park walls inclosing the United States lands at the Duluth Canal have been completed.

The filling of the large submerged areas on either side of the canal, involving the deposit of about 50,000 cubic yards of material, has been completed.

The dredging operations, which were completed November, 1902, have given 17 miles of dredged channels from 120 to 600 feet in width and basins of an aggregate area of about 360 acres, all of a depth of 20 feet or over, at low-water datum, which must be maintained thereafter by dredging as needed.

The district officer believes that this work can best be done by plant owned and operated by the United States, the cost of which is estimated at \$150,000. With this plant provided it is estimated that the channels and basins can be maintained for an annual sum equivalent to about 3 mills per ton for the vessel freight of the harbor each year.

The piers at the Wisconsin Entry were placed about thirty-two years ago in water of an average depth of 8 to 10 feet, the object then being to secure a depth of 12 feet in the channel. With the growth of commerce the channel depth has been increased to 24 feet, and the crib bottoms are now many feet above the bottom of the channel. Owing to this and other causes considerable displacement has resulted and the present piers are to be replaced by new ones.

The work of construction of the new piers was begun in the spring of 1903. The estimated cost of this work is \$925,000. The balance from the appropriations authorized by the act of June 3, 1896, is \$275,000.

The act of Congress approved June 13, 1902, appropriated \$200,000 for the improvement of Duluth-Superior Harbor, and provided that not less than \$100,000 of this amount should be expended in prosecuting the work of rebuilding the piers at the Wisconsin Entry of this harbor.

The least depth at low-water datum at any part of the area under improvement is 20 feet.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

The head of navigation is at the foot of the rapids just above the village of Fond du Lac, on the St. Louis River, about 20 miles from Lake Superior.

The improvements made are in excellent condition, and the expenditure has been amply justified by the immense commerce which it has readily accommodated.

The lake commerce of this port, Duluth-Superior, during the last season of navigation amounted to 17,505,793 tons (of 2,000 pounds), valued at \$194,444,695, and from the beginning of improvements by the United States in 1867 to the close of the calendar year 1902 the vessel freight entering and departing has amounted to 120,964,166 tons (of 2,000 pounds), valued at \$1,809,102,514.

The tonnage for 1902 is much the largest in the history of the port.

It is believed that the tonnage of Duluth-Superior Harbor is now exceeded by that of but two ports in the United States, New York and Philadelphia.

The additional work proposed is for the purpose of extension of benefits by increasing facilities of navigation and making present improvements more permanent in character.

Report of the examination of St. Louis River, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$828, 858. 10
Amount received from sales of United States property	550. 00
	829, 408. 10
June 30, 1903, amount expended during fiscal year	412, 590. 39
July 1, 1903, balance unexpended	416. 817. 71
July 1, 1903, outstanding liabilities	15, 000. 00
July 1, 1903, balance available	401, 817. 71
July 1, 1903, amount covered by uncompleted contracts	165, 000. 00
{ Amount (estimated) required for completion of existing project	520, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix K K 3.)	

4. *Harbor at Portwing, Wis.*—The harbor of Portwing, formed by the mouth of Flag River, is situated on the south shore of Lake Superior, about 33 miles from the head of the lake.

The harbor has been improved by private parties to some extent, but this improvement is of a temporary character.

Before improvement the depth was small and variable.

In accordance with the provisions of the act of Congress approved March 3, 1899, a report upon a survey of this harbor and a project for its improvement were submitted on November 20, 1899.

This project provided for the construction of two parallel piers of piling, filled in with slabs and topped with large rock. These piers were to be located 200 feet apart, and to be 800 feet and 825 feet long, respectively. A channel 150 feet wide and 15 feet deep was to be dredged between the piers and for 500 feet along the slough. The estimated cost of the improvement was \$44,992.

By act of Congress approved June 13, 1902, this project was adopted, and the sum of \$25,000 was appropriated, provided the United States

should, before the commencement of operations, be given clear title, without cost, to all lands needed for the improvement.

This provision was complied with by a deed to the United States dated July 9, 1902, conveying 7 acres of land at the harbor entrance.

Under the approved project work was begun June 1, 1903. The entrance channel has been partially deepened and the east pier partially built.

The dredging, up to June 30, 1903, has resulted in a narrow channel through the entrance which will allow a maximum draft of 14 feet at low-water datum. Vessels drawing 15 feet can enter at present stage and proceed to the wharf.

The usual variation of water level extends from about 0 to +1 foot above low-water datum.

Private dredging has extended a navigable channel to a distance of about 2,500 feet southerly from the main entrance, giving access to a lumber wharf which extends along its entire length, and to a small commercial wharf.

July 1, 1902, balance unexpended	\$25,000.00
June 30, 1903, amount expended during fiscal year	781.36
July 1, 1903, balance unexpended	24,218.64
July 1, 1903, amount covered by uncompleted contracts	23,500.00
{ Amount (estimated) required for completion of existing project	19,992.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	12,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix K K 4.)

5. *Harbor at Ashland, Wis.*—Ashland Harbor is located at the head of Chequamegon Bay, and originally had no protection from the waves which rolled into the bay, nor from waves generated within the bay itself by storms.

The original project, approved December 7, 1888, and modified February 9, 1889, was for the construction of a pile, slab, and rock breakwater 8,000 feet long and for dredging a channel in front of the wharves of the city. The act of March 3, 1899, added to this project by authorizing an extension of the breakwater to the shore, thus requiring the ultimate construction of 10,200 feet of breakwater. The emergency river and harbor act of June 6, 1900, provided for building a shore spur 4,700 feet in length from a point 2,600 feet east of the prolongation of the present breakwater and parallel thereto. This again changed the project, adding greatly to the total length of breakwater to be constructed and largely to the total expense.

Under this project and its two modifications there has been constructed 7,454 feet of breakwater on the original line, and 842 feet on the line fixed by the act of June 6, 1900.

Of the 7,454 feet on the original line, 91 feet is detached and uncompleted work near shore, and 7,363 feet is completed breakwater in one piece.

The total amount expended on this project and its modifications up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$275,698.56, of which amount \$83,500 has been applied to the maintenance of the improvement.

The work done gives a protected area of about 1,600 acres, and affords safe anchorage and dockage for a distance of 3 miles along the city front.

The pile, slab, and rock breakwater on the original line is in very poor condition and has required large expenditures for maintenance.

The work of revetting this structure with riprap so as to form a permanent rubble-mound breakwater was begun in May, 1903.

The southerly half of the 20-foot channel dredged in 1897, parallel to the harbor line, has shoaled in places to a depth of about 16 feet. The northerly half has shoaled but little. In June, 1903, this channel was extended about 900 feet westward, parallel to the harbor line, 20 feet deep and 100 feet wide. The maximum draft that can be carried June 30, 1903, at mean low water (low-water datum) is 19 feet.

The usual variation of level of the water surface extends from about 0 to +1 foot above low-water datum.

The commerce of this port consists principally of iron ore and lumber exported, and coal, mineral oil, and general merchandise imported.

The commerce has increased during the sixteen years the harbor has been under improvement by the United States from 892 arrivals and clearances, with cargo tonnage of 1,400,000 tons (of 2,000 pounds) in 1887, to 2,618 arrivals and clearances, with cargo tonnage of 4,625,450 tons (of 2,000 pounds), valued at \$16,701,927, in 1902, the total commerce from 1887 to 1902, inclusive, being estimated at 47,618,562 tons (of 2,000 pounds), valued at \$403,659,566.

July 1, 1902, balance unexpended	\$40, 829. 37
June 30, 1903, amount expended during fiscal year	2, 027. 93

July 1, 1903, balance unexpended	38, 801. 44
--	-------------

July 1, 1903, amount covered by uncompleted contracts.....	31, 000. 00
--	-------------

{ Amount (estimated) required for completion of existing project	386, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....	75, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 5.)

6. *Harbor at Ontonagon, Mich.*—The entrance to Ontonagon River, which forms the harbor, had but 7 feet depth in 1867, at which time the project for securing 12 feet depth by building parallel piers on either side of the mouth, extending to the 18-foot curve of depth in Lake Superior, and dredging a channel between the piers, was adopted. The west pier was built to a length of 2,675 feet and the east pier to a length of 2,315 feet. This brought the outer end of the west pier very nearly to the 18-foot curve of depth, as proposed.

As far as new work is concerned the project has been completed since 1889, and further expenditure will be needed only for keeping a 12-foot channel open by dredging and for the repairs to the piers.

The amount expended on this improvement up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$344,971.13, of which sum \$60,163.40 has been spent for maintenance of the improvement.

The last dredging between the entrance piers was done in 1894. The last dredging in the vicinity of the wharves was done in 1896. Shoaling has gradually occurred so that in May, 1903, there was but

11 feet available between the piers, at low-water datum, and but 10 feet between the entrance piers and the city wharves. The east pier is in good condition, the west pier somewhat decayed, but will not require repairs for a few years longer. Dredging is now in progress for the removal of shoals.

The usual variation of water level extends from 0 to + 1 foot above low-water datum.

The great fire in 1896 destroyed the principal commercial industry, the plant of the Diamond Match Company, and this company has not rebuilt.

The town itself is recovering steadily from the effects of this fire, which almost obliterated it, and, as it has a fine agricultural region tributary to it, the new growth has every appearance of permanency.

In 1867 there were 449 arrivals and departures, with 5,000 tons of cargo, and in 1902 there were 288 arrivals and departures, with 5,735 tons (of 2,000 pounds) of cargo, valued at \$463,309.

The commerce of this port since the commencement of operations by the United States is estimated at 2,710,864 tons (of 2,000 pounds), valued at \$71,365,000.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$5,320.27
June 30, 1903, amount expended during fiscal year	163.40
July 1, 1903, balance unexpended	5,156.87
July 1, 1903, outstanding liabilities.....	10.00
July 1, 1903, balance available	5,146.87
July 1, 1903, amount covered by uncompleted contracts	4,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 6.)

7. *Waterway across Keweenaw Point, from Keweenaw Bay to Lake Superior, Michigan.*—This work was formerly reported on as the Portage Lake and Lake Superior canals, across Keweenaw Point, Michigan.

In accordance with the provisions of the river and harbor act of September 19, 1890, the United States purchased and assumed the charge and care of these canals on August 3, 1891.

At the time of the purchase by the United States there was a very poor 13-foot navigation; the channel was narrow and crooked, with many sharp bends; it was poorly marked and lighted; the entrance piers were in a very bad condition, the revetments were decayed or entirely gone, and there was a tax on the commerce through the canals in the shape of a tonnage charge.

The original project, adopted January 24, 1887, was—

1. For a 16-foot channel of 70 feet bottom width from bay to lake.
2. A renewal of the canal revetments.
3. A reconstruction of the piers at the Lake Superior entrance and their extension to 30 feet depth of water.

10. *Harbor of refuge, Marquette Bay, Michigan.*—Marquette Bay, also known as Presque Isle Harbor, is a small bay within the city limits of Marquette, north of Marquette proper, and distant $1\frac{1}{4}$ miles therefrom.

Before improvement the locality was fully exposed to storms from the east and northeast, and comparatively little shipping was done.

A resolution of Congress approved March 20, 1896, directed the Secretary of War to make a survey and submit an estimate for a breakwater in this bay. The results of this survey, with estimates amounting to \$20,000 for breakwater 500 feet long and \$50,000 for construction of one 1,000 feet long, are published in House Document No. 318, Fifty-fourth Congress, first session.

The project adopted by the act of June 3, 1896, is to build a breakwater 1,000 feet in length off Presque Isle Point.

This breakwater was completed to its full length in July, 1900.

The act of Congress approved June 13, 1902, provided that a portion of the appropriation for Marquette Harbor "not exceeding seven thousand five hundred dollars may be expended in connecting the Presque Isle breakwater with the shore."

Under this provision the gap between the breakwater and shore was closed, in the fall of 1902, by a timber pier 216 feet long, and 100 linear feet of shore revetment constructed.

No additional work is proposed.

The total amount expended on the project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, was \$49,590.58, of which \$2,000 was expended for maintenance.

The work done has enabled vessels to lie in safety at the ore pier and other docks in the vicinity, and shipping has increased greatly.

This harbor is largely used for commercial purposes, but to little or no extent as a harbor of refuge.

Vessels drawing 18 feet or less can reach the ore pier at ordinary stages of the lake.

The usual variation of water level extends from 0 to +1 foot above low-water datum.

July 1, 1902, balance unexpended	\$469.42
June 30, 1903, amount expended during fiscal year	60.00
July 1, 1903, balance unexpended	409.42

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	1,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix K K 9.)

11. *Harbor of refuge at Grand Marais, Mich.*—Originally the entrance to this harbor was obstructed by a bar having but 9 feet depth of water upon it. The project for its improvement, adopted August 5, 1881, and modified December 21, 1894, has for its object a deep and safe channel into the harbor, making it a harbor of refuge. This object is to be attained by building parallel piers 500 feet apart projecting into the lake to a depth of 22 feet, and dredging out an 18-foot channel between them, connecting the deep water of the lake with that of the harbor, and by closing up the natural entrance, 5,770 feet in width, by a solid pile dike, driven with a slope toward the waves and strongly

braced. The proposed length of each pier was 1,800 feet. The estimated cost of the entire project was \$184,000. The west pier has now reached a length of 1,656 feet, the east pier 1,353 feet, and the pile dike is completed. The outer 200 feet of the east pier has been provided with a superstructure the present season, and extensions to the piers toward deep water are now under construction.

The amount expended on the project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, was \$333,439.57, of which \$25,000 was expended for maintenance.

In May, 1903, there was a least depth in the entrance between the piers of about 13 feet.

The usual variation of water level extends from about 0 to about + 1 foot above low-water datum.

The present depth is not sufficient to afford refuge for the larger class of vessels.

July 1, 1902, balance unexpended	\$70,000.00
Amount received account sale United States property.....	125.00
	70,125.00
June 30, 1903, amount expended during fiscal year	2,841.25
	July 1, 1903, balance unexpended
	67,283.75
July 1, 1903, outstanding liabilities	2,000.00
	July 1, 1903, balance available
	65,283.75
	July 1, 1903, amount covered by uncompleted contracts.....
	45,200.00
{ Amount (estimated) required for completion of existing project	83,401.68
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance available July 1, 1903	70,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4,	
1897.	

(See Appendix K K 10.)

12. Removing sunken vessels or craft obstructing or endangering navigation.—The wreck of the steamer *Toledo* was removed from Portage Lake canals, Michigan, at a cost of \$400.

(See Appendix K K 11.)

IMPROVEMENT OF RIVERS AND HARBORS ON WESTERN SHORE OF LAKE MICHIGAN.

This district was in the charge of Maj. J. G. Warren, Corps of Engineers. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. Menominee Harbor and River, Michigan and Wisconsin.—Prior to act of June 13, 1902, the harbor and river constituted two works; by this act they were consolidated.

(a) *Harbor.*—Original depth of channel, about 5 feet; width, 200 feet. Project adopted in 1874 to obtain a depth of 15 feet; modified in 1899 for increasing the depth to 20 feet. Amount expended on original and modified projects, \$234,344.77.

(b) *River.*—Original navigable depth, 5 feet. Project adopted in 1890 to obtain a depth of 17 feet. Expended on original and modified projects, \$114,414.15.

(c) *Harbor and river.*—The existing project adopted by act of Congress approved June 13, 1902, provides for increasing the depth to 20 feet. Estimated cost, \$60,000.

The expenditures during the fiscal year, amounting to \$13,836.47, were in furtherance of the existing project, and resulted in increasing the length of the 20-foot channel about 5,550 feet.

The channel has a depth of 20 feet from the 20-foot contour in Green Bay for a distance of about 7,000 feet; thence about 3,000 feet a depth of 17 feet; thence about 1,700 feet a depth of 20 feet.

The river is not navigable above the western end of the improved channel.

Maximum draft that could be carried June 30, 1903, was 19 feet in the first section of the channel, and 16 feet in the remainder. Usual mean annual variation in level of water surface is 0.99 foot.

The commercial statistics show the value, changes, and character of commerce benefited.

The additional work proposed is the making of needed repairs to the harbor piers and completing the channel and basin.

A part of the existing project involves the dredging of a channel 425 feet long and 60 to 75 feet wide between the properties of I. Stephenson and Company, Smith, Thorndike and Brown, and the N. Ludington Company, at the extreme westerly end of the proposed improvement. The bed of this channel is of rock. It is apparent that its improvement would be of local interest only, as it is more in the nature of a slip than a public waterway. It is therefore recommended that the project be modified to omit the channel above described. Dredging under the contract now in force has disclosed a greater amount of hardpan and bowlders in the remainder of the work than was first contemplated, consequently no reduction in the amount necessary to complete the project is recommended at this time.

More extended information and maps are printed in Annual Report of the Chief of Engineers for 1893, page 2706, and 1896, pages 2460 and 2463. For reports on examinations and surveys, see House Documents No. 86, Fifty-fourth Congress, second session (Annual Report for 1897, p. 2751), and No. 419, Fifty-sixth Congress, first session (Annual Report for 1900, p. 3739).

Commercial statistics.—Arrival of vessels, 1,336; exports and imports, 1,155,269 tons.

July 1, 1902, balance unexpended	\$50, 803. 11
Miscellaneous receipts	1, 527. 00
June 30, 1903, amount expended during fiscal year	52, 330. 11
	13, 836. 47
July 1, 1903, balance unexpended	38, 493. 64
July 1, 1903, amount covered by uncompleted contracts	23, 326. 46
{ Amount (estimated) required for completion of existing project	9, 650. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 1.)

2. *Oconto Harbor, Wisconsin.*—The original depth at the mouth of the river, about 3 feet, was increased by private enterprise to 4 feet before work was begun by the United States.

With funds appropriated by Congress in 1881 and 1882, operations

were begun in 1882 for the formation of a channel 100 feet wide and 9 feet deep, extending from Green Bay up the river for a distance of about 2 miles. In 1897 the project was modified so as to omit 3,800 feet of the upper end of the channel upon which no work had been done. The estimated cost of the modified project was \$115,610. The amount expended to June 30, 1903, was \$92,349.77, of which amount \$7,780.30 was applied to maintenance of the improvement.

The 9-foot channel was completed to the required width in 1899, except for a distance of about 600 feet.

The maximum draft that could be carried June 30, 1902, was about 7.5 feet. No soundings have been taken since then. One thousand feet above the westerly end of the Government improvement the Oconto River has a navigable depth of about 3 feet.

Mean annual variation in level of water surface is 0.99 foot.

The volume of commerce benefited is very small, and it is of a purely local character.

It is recommended that the balance now available be used for maintenance of the piers, with a view to their possible usefulness at some future time, and that until there be a change in commercial conditions no further appropriations be made.

In pursuance of a resolution of the Committee on Rivers and Harbors of the House of Representatives the Board of Engineers for Rivers and Harbors has considered the project for this work and has submitted a special report thereon, which will be found by reference to Appendix L L 2.

For more extended information and maps see Annual Report of the Chief of Engineers for 1888, page 1840, and for 1896, pages 2465 and 2561-2564.

For reports on examinations and surveys, see House Documents No. 223, Fifty-fourth Congress, first session (Annual Report for 1896, p. 2560), and No. 50, Fifty-sixth Congress, first session (Annual Report for 1900, p. 3745).

July 1, 1902, balance unexpended	\$3,908.95
June 30, 1903, amount expended during fiscal year	258.72

July 1, 1903, balance unexpended	3,650.23
--	----------

(See Appendix L L 2.)

3. *Greenbay Harbor, Wisconsin.*—This work consists of two improved channels: First, from the mouth of Fox River northerly to the 17-foot contour in Green Bay; second, Fox River, below Depere, to the southerly limits of the city of Greenbay. The intervening pool in Fox River connecting these channels had a natural depth of from 25 feet to 40 feet, and required no improvement. The outer channel was originally circuitous and narrow, with an available depth of 11 feet. The original navigable depth of the inner channel was also 11 feet.

The original projects for the improvement of these channels were adopted in 1866 and 1892, respectively, to obtain a depth in each of 13 feet; subsequent modifications provided for increasing their depths to 17 feet. The width of the outer channel varies from 200 feet to 500 feet; width of inner channel, 150 feet. These channels were completed by the expenditure of \$405,945.18.

The existing project, adopted by Congress by act approved June 13, 1902, provides for increasing the depth of the outer channel to 20 feet

at an estimated cost of \$105,600. It also provides for maintenance of existing works.

The expenditures during the fiscal year, amounting to \$13,301.68, were in furtherance of the existing project, of which amount \$2,801.89 was for maintenance, and the remainder, \$10,499.79, for dredging under the present contract.

The maximum draft that could be carried June 30, 1903, was 16 feet. The mean annual variation in level of water surface is 0.99 foot.

The commercial statistics indicate that the volume of commerce is large and that it is of a general character.

Connecting with the upper end of the inner channel at Depere, Fox River is navigable by canals and slack-water navigation to Portage, Wis., a distance of 156 miles.

No additional work is proposed other than the completion of the contract now in force in order to secure a depth of 20 feet in the outer channel and maintenance of existing works.

For more extended information and maps, see Annual Report of the Chief of Engineers for 1894, pages 2053, 2054, and for 1896, page 2469. For reports on examinations and surveys, see House Executive Document No. 22, Fifty-second Congress, second session, and House Document No. 232, Fifty-sixth Congress, first session.

Commercial statistics for 1902.—Arrivals of vessels, 1,391; exports and imports, 1,135,498 tons.

July 1, 1902, balance unexpended	\$105, 857. 32
June 30, 1903, amount expended during fiscal year	13, 301. 68
July 1, 1903, balance unexpended	92, 555. 64
July 1, 1903, amount covered by uncompleted contracts	85, 500. 21

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	8, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 3.)

4. *Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin, and harbor of refuge connected therewith.*—Prior to act of June 13, 1902, the canal and harbor constituted two works; by this act they were consolidated.

(a) *Canal.*—In its natural condition Lake Michigan was separated from Sturgeon Bay, an arm of Green Bay, by a neck of land about 1½ miles wide, having a maximum elevation above the lake level of about 28 feet. The Sturgeon Bay and Lake Michigan Ship Canal and Harbor Company from 1872 to 1881 constructed across this neck a canal, without locks or gates, 7,200 feet long, 100 feet wide at water surface, and 14 feet deep, and in continuation of the canal dredged a channel in Sturgeon Bay 6,100 feet long, of about same dimensions as the canal. Of the 14,400 linear feet of canal banks, 8,437 feet was provided with pile revetments. The United States assumed possession of the canal April 25, 1893.

The project adopted in 1894 and modified in 1896 provides for completing the revetments, widening the canal to 160 feet, except the westerly 1,000 feet, which is to be 250 feet wide between revetments, with a channel width of 200 feet and a channel 15 feet deep, and was completed during the present fiscal year.

(b) *Harbor*.—Before the construction of this harbor was undertaken the Lake Michigan entrance to the Sturgeon Bay and Lake Michigan Ship Canal was entirely unprotected from storms from northeast to southwest.

The project of constructing a harbor of refuge at this point was adopted in 1873 and modified in 1879 and 1880. The modified project, as carried out and completed in 1884, consisted of two piers, each 1,344 feet long, 850 feet apart at the shore line, protecting the lake entrance to the canal and converging so as to make the harbor entrance 335 feet wide, and inclosing an area of about 10 acres, with a depth of at least 17 feet.

The amount expended on the foregoing projects to June 30, 1902, was \$349,119.26.

(c) *Canal and harbor*.—The existing project adopted by act of Congress approved June 13, 1902, provides for maintenance and for increasing the depth of channel to 21 feet from Lake Michigan to Sturgeon Bay; estimated cost, \$222,000.

Operations under the contract now in force to complete the existing project by December 31, 1904, were begun May 25, 1903, and are in progress at the close of the fiscal year. The expenditures to June 30, 1903, \$13,642.45, were applied to existing project.

The depth below datum of channel in the canal is 15 feet and in the harbor 17 feet.

The maximum draft that could be carried June 30, 1903, was 14.5 feet in the canal and 16.5 feet in the harbor.

The mean annual variation in level of water surface is 0.99 foot.

The commercial statistics indicate that the volume of commerce is large and of a general character.

For more extended information and maps, see Annual Reports of the Chief of Engineers for 1893, pages 2714–2720, and 1896, pages 2471–2483.

For report on examination and survey, see House Document No. 117, Fifty-sixth Congress, second session (also Annual Report for 1901, page 2970).

No additional work is proposed other than to complete the contract now in force in order to secure a 21-foot channel and for maintenance of existing works.

Commercial statistics for 1902.—Number of vessels passing through canal, 3,300; tonnage, 638,835; estimated value of cargoes, \$21,947,885.85. Number of vessels seeking shelter, 227; tonnage, 51,714. Number of passengers passing through canal, 15,861. Decrease in value of cargoes in 1902 compared with 1901, \$521,216.

July 1, 1902, balance unexpended	\$45,503.39
Miscellaneous receipts	11,593.90
Amount appropriated by sundry civil act approved March 3, 1903	178,000.00

	235,097.29
June 30, 1903, amount expended during fiscal year	13,642.45

July 1, 1903, balance unexpended	221,454.84
July 1, 1903, outstanding liabilities	139.01

July 1, 1903, balance available	221,315.83
---------------------------------------	------------

July 1, 1903, amount covered by uncompleted contracts	163,969.55
---	------------

(See Appendix L L 4.)

5. *Operating and care of Sturgeon Bay and Lake Michigan Ship Canal, Wisconsin.*—Under an allotment from the indefinite appropriation of July 5, 1884, for operating and care of canals and other works of navigation, there was expended during the fiscal year ending June 30, 1903, \$7,345.15.

Repairs were made to the revetments at various places where needed, and to the buildings and plant pertaining to the canal. The removal of 234 linear feet of the south revetment and rebuilding it on the rectified line is in progress. The premises in the vicinity of the office and watchhouses were graded and otherwise improved and the canal operated and cared for in accordance with the approved project.

Navigation through the canal opened April 4, 1902, closed by ice December 16, and resumed March 16, 1903.

For commercial statistics, see report upon improvement of Sturgeon Bay and Lake Michigan Ship Canal, and harbor of refuge connected therewith.

(See Appendix L L 5.)

6. *Ahnapee Harbor, Wisconsin.*—Previous to the improvement of this harbor the depth of water at the mouth of the Ahnapee River was only 3 feet, and the present harbor was not available for purposes of commerce.

The original project adopted in 1875 provided for the formation of a small artificial harbor connected with the lake by a channel 100 feet wide and 13 feet deep, by pier construction, dredging, and rock removal.

Amount expended on original and modified projects prior to operations under existing project, \$180,033.50.

The project adopted by Congress, by act approved March 3, 1899, provides for extending the 13-foot channel for a width of 50 feet, a distance of 800 feet, by rock removal and dredging. Estimated cost, \$19,266.

The extension of channel provided for by project of 1899 is only partially completed. Its depth is 10 feet; least width, 30 feet for a distance of 520 feet.

The amount expended up to June 30, 1903, was \$16,786.81, of which \$13,000 was for rock removal and dredging under existing project, and \$3,786.81 for maintenance.

The maximum draft that could be carried June 30, 1903, was about 12 feet. The mean annual variation in level of water surface is 0.99 foot.

Ahnapee, or Wolf, River is navigable for a distance of about 7 miles from its mouth for crafts drawing 6 feet, but there are no vessels plying on it. The additional work proposed is for completion of the existing project and for maintenance.

The volume of commerce benefited is small and of a local character.

For more extended information and maps, see Annual Reports of the Chief of Engineers for 1876, pages 346-363; 1888, page 1846, and 1896, page 2483.

For report on examination and survey, see House Document No. 172, Fifty-fourth Congress, second session (also Annual Report for 1897, pp. 2755-2761).

July 1, 1902, balance unexpended	\$10, 836. 27
June 30, 1903, amount expended during fiscal year	1, 436. 58
July 1, 1903, balance unexpended	9, 399. 69
{ Amount (estimated) required for completion of existing project	6, 266. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 6.)

7. *Kewaunee Harbor, Wisconsin.*—The original entrance to the Kewaunee River was not more than 20 feet wide, with a depth of about 3 feet at its shoalest point, and was obstructed by submerged bowlders. The present harbor was therefore not available for purposes of commerce.

The original project for its improvement, adopted in 1881, which is the existing project, provided for an artificial entrance channel 15 feet deep, located about 2,000 feet south of the river mouth, protected by two parallel piers 200 feet apart, extending from the shore to the 19-foot contour in the lake. Estimated cost, \$200,000. The project was completed in 1898 at a cost of about \$150,000.

The amount expended up to June 30, 1903, was \$161,290.08, of which amount \$11,290.08 was for maintenance.

The maximum draft that could be carried June 30, 1903, was about 14 feet. The mean annual variation in level of water surface is 0.99 foot.

The commercial statistics indicate that the volume of commerce benefited is quite large and that it is of a general character.

Connecting with the westerly end of the improved channel Kewaunee River has a navigable depth of 4 feet for a distance of about 6½ miles, but there is no regular commerce on the river. No additional work is proposed other than for maintenance.

For more extended information and maps, see Annual Report of the Chief of Engineers for 1881, pages 2080–2088, and for 1897, page 2675.

For report on examination and survey, see House Document No. 362, Fifty-sixth Congress, first session (Annual Report for 1900, pp. 3752–3758).

Commercial statistics for 1902.—Arrivals of vessels, 1,388; exports and imports, 1,007,565 tons.

July 1, 1902, balance unexpended	\$11, 529. 48
June 30, 1903, amount expended during fiscal year	2, 967. 37
July 1, 1903, balance unexpended	8, 562. 11

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	3, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 7.)

8. *Two Rivers Harbor, Wisconsin.*—The original depth of the entrance to Twin Rivers was from 3 to 4 feet, and the present harbor was not available for purposes of commerce.

The original project adopted in 1870 provided for the formation of

a channel of navigable width and 13 feet deep, connecting Twin Rivers with Lake Michigan by building parallel piers extending to the 19-foot contour and dredging between them.

In 1897 the piers terminated at the 14-foot contour, and a modification then adopted provided for abandoning their further extension. At that date a channel of the required depth had been obtained at an expenditure of \$214,500. Since then the expenditures have been for maintenance.

The total expenditure to June 30, 1903, was \$225,191.16, of which \$10,691.16 was for maintenance.

The maximum draft that could be carried June 30, 1903, was about 12 feet. The mean annual variation in level of water surface is 0.99 foot.

East and West Twin Rivers have a navigable depth of 7 feet for a distance of about 3 miles and 7 miles, respectively, from the harbor piers. There is no regular commerce on these rivers; for many years they have been used only by rowboats and for floating saw logs.

The volume of commerce benefited is small and of a local character.

For more extended information and maps, see Annual Report of the Chief of Engineers for 1893, page 2728; 1896, page 2489, and 1897, page 2678.

For report on examination and survey, see House Document No. 45, Fifty-sixth Congress, first session (Annual Report for 1900, page 3759).

No additional work is proposed other than for maintenance of existing works.

July 1, 1902, balance unexpended	\$20,481.00
June 30, 1903, amount expended during fiscal year.....	3,172.16
July 1, 1903, balance unexpended	17,308.84

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	3,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 8.)

9. *Manitowoc Harbor, Wisconsin.*—The original depth of water at the mouth of Manitowoc River was about 4 feet at the shoalest point, and the existing harbor was not available for purposes of commerce.

The original project, adopted in 1854, provided for building parallel piers 220 feet apart and dredging between them to obtain a channel 12 feet in depth connecting Manitowoc River with Lake Michigan. It was subsequently modified to increase the depth of channel to 20 feet, and to protect the same from northeast seas by a breakwater 400 feet long. These projects were completed at an expenditure of \$401,827.75.

The existing project, adopted by Congress by act approved June 13, 1902, provides for extending the breakwater 400 feet, at an estimated cost of \$37,000, for a survey, and for maintenance, \$8,000, making a total of \$45,000.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, was \$3,226.44 for maintenance, resulting in making urgent repairs to the harbor piers, and for completing survey.

Connecting with the western end of the Government improvement,

Manitowoc River is navigable for a distance of about 1 $\frac{1}{10}$ miles. The extension of the breakwater, now in progress, is designed to diminish the disturbance in the harbor caused by northeasterly seas.

The maximum draft that could be carried June 30, 1903, was about 19 feet. The usual mean annual variation of level of water surface is 0.99 foot.

A survey of the harbor and river has been made, in compliance with requirements of the river and harbor act of June 13, 1902, and report thereon dated July 13, 1903, with plan and estimate of cost of improvement, is submitted herewith in Appendix L L 19.

The volume of commerce benefited is large, and is of a general character.

For more extended information and maps see Annual Report of the Chief of Engineers for 1876, pages 52-58; 1888, page 1851, and for 1893, page 2731.

For reports on examinations and surveys see House Documents No. 300, Fifty-fourth Congress, first session, and No. 233, Fifty-sixth Congress, first session (see Annual Reports for 1900, p. 3761, and 1901, p. 2979).

Commercial statistics for 1902.—Arrivals of vessels, 2,006; exports and imports, 804,969 tons.

July 1, 1902, balance unexpended	\$46,984.97
June 30, 1903, amount expended during fiscal year	3,226.44
July 1, 1903, balance unexpended	43,758.53
July 1, 1903, amount covered by uncompleted contracts	35,000.00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	4,840.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 9.)

10. *Sheboygan Harbor, Wisconsin.*—The depth of water over the bar at the mouth of the Sheboygan River originally did not exceed 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1866, provided for extending the piers built by the city and county of Sheboygan, and for a channel between them 13 feet deep. Subsequent modifications provided for extending the piers and increasing depth of channel to 19 feet.

The amount expended on original and modified projects prior to operations under present project is \$393,734.

The existing project, adopted by acts of March 3, 1899, and June 13, 1902, provides for a breakwater 700 feet long, for extending both harbor piers, and for a channel 21 feet deep. Estimated cost, \$152,000 (see House Docs. No. 327, 54th Cong., 2d sess., and No. 53, 55th Cong., 3d sess.; also Annual Report of the Chief of Engineers for 1897, p. 2761, and 1901, p. 2932).

The total amount expended on existing project up to June 30, 1903, was \$84,883.14, of which sum \$6,863.14 was for maintenance.

Six hundred feet of the breakwater is built, and the 19-foot channel increased to a depth of 21 feet below datum for a minimum width of 60 feet.

The maximum draft that could be carried June 30, 1903, was 20

feet. The usual mean annual variation of level of water surface is 0.99 foot.

Connecting with the westerly end of the Government improvement Sheboygan River is navigable for a distance of about $1\frac{1}{2}$ miles.

For more extended information and maps see Annual Reports for 1897, page 2761, and 1899, page 2812, and 1901, page 2932.

For reports on examinations and surveys see House Documents No. 327, Fifty-fourth Congress, second session, and No. 53, Fifty-fifth Congress, third session; also Annual Report for 1897, page 2761, and for 1899, page 2813.

Commercial statistics for 1902.—The commerce of Sheboygan is quite large and general in its character. Arrivals of vessels, 1,318; exports and imports, 1,295,718 tons.

July 1, 1902, balance unexpended	\$93, 094. 91
June 30, 1903, amount expended during fiscal year	6, 863. 14
July 1, 1903, balance unexpended	86, 231. 77
July 1, 1903, outstanding liabilities	1, 194. 55
July 1, 1903, balance available	85, 037. 22
July 1, 1903, amount covered by uncompleted contracts	69, 261. 50

(Amount (estimated) required for completion of existing project	11, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	18, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix L L 10.)	

11. *Port Washington Harbor, Wisconsin.*—The natural channel at the mouth of the Sauk River was narrow, and at the shoalest point had a depth of 1 foot, and the present harbor was not available for purposes of commerce.

The project adopted in 1869 and modified in 1876 provides for a channel 13 feet deep between parallel piers 150 feet apart and for two interior basins having a depth of 13 feet and a combined area of about $5\frac{1}{2}$ acres; estimated cost, \$181,527.17. (See Annual Reports of the Chief of Engineers for 1876, Part II, p. 379, and for 1881, p. 2109.)

The existing project was completed in 1895 at a cost of \$184,848.39. Since that time \$14,461.17 has been expended for maintenance, etc., making a total to June 30, 1903, of \$199,309.56, of which amount \$1,480.92 was expended during the fiscal year.

The maximum draft that could be carried June 30, 1903, was 12 feet. The usual mean annual variation of levels of water surface is 0.99 foot.

The volume of commerce benefited is small, and is of a local character.

No additional work is proposed other than maintenance of existing works.

For more extended information and maps see Annual Report for 1893, page 2740, and 1896, page 2498.

For report on examinations and survey see House Document No. 44, Fifty-sixth Congress, first session (also Annual Report for 1900, p. 3766).

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Commercial statistics for 1902.—Arrivals of vessels, 1,354; imports, 58,754 tons; departures of vessels, 1,354; exports, 7,035 tons.

July 1, 1902, balance unexpended	\$7, 107. 86
June 30, 1903, amount expended during fiscal year	1, 480. 92
July 1, 1903, balance unexpended	5, 626. 94

(See Appendix L L 11.)

12. *Milwaukee Harbor, Wisconsin, including harbor of refuge.*—Milwaukee Harbor and the harbor of refuge, which were originally separate works, were consolidated by the act of June 13, 1902.

The original depth of water at the mouth of Milwaukee River was not more than 4½ feet, and the present harbor was not available for purposes of commerce. Milwaukee Bay, in which the harbor of refuge is located, is protected by the coast from storms, except those from the northeast to the southeast, and, while the anchorage ground is good, vessels were in danger of dragging their anchors or of failing to effect anchorage at the proper place.

The original project for the improvement of Milwaukee Harbor was adopted in 1845–46, and provided for dredging the original river mouth and protecting the entrance by parallel piers. Subsequent modifications provided for the abandonment of the improvement of the original river mouth, and for the formation of a channel 19 feet deep through the point overlapping the mouth of the river and about 3,000 feet northerly from the original outlet, the channel to be protected by parallel piers.

The amount expended on the original and modified projects prior to operations under the present project is \$402,752.28, of which \$50,400 was expended at original mouth of river. (See House Document No. 61, Fifty-fourth Congress, second session.)

The modified project, adopted by act of March 3, 1899, provides for a channel 21 feet deep, minimum width between piers to be 200 feet, and the width outside of the pierheads to be 600 feet. Estimated cost, \$12,000, and \$3,000 annually for maintenance.

The project for the harbor of refuge was adopted in 1881, and provides for a breakwater 7,650 feet long, including an opening therein of 400 feet. Original estimated cost, \$800,000 (see Annual Report of the Chief of Engineers for 1881, p. 2116 et seq.); revised estimate, \$955,650 (see Annual Reports of the Chief of Engineers for 1896, p. 2504, and for 1897, p. 2690).

The total amount expended on the original and modified projects to June 30, 1902, is \$959,464.67, of which \$939,153.50 is for breakwater, \$12,000 for 21-foot channel, and \$8,311.17 for maintenance.

The projects for both the harbor and harbor of refuge are completed, the full projected depth of channel having been secured and the breakwater built to its full projected length.

The maximum draft that could be carried June 30, 1903, was 20 feet. The mean annual variation of level of water surface is 0.99 foot.

By act of June 13, 1902, \$232,500 was appropriated for maintenance, of which amount \$150,000 was authorized to be expended upon the breakwater.

This is the existing project, and the appropriation is being expended in providing about 2,450 feet of the breakwater and 1,050 feet of the north harbor pier with concrete superstructure, under contract to be completed by December 31, 1904. Five thousand four hundred and

seventy nine dollars and twenty-nine cents was expended to June 30, 1903.

Connecting with the Government improvement of Milwaukee River the city of Milwaukee has dredged and made navigable—

The Milwaukee River, about $2\frac{1}{4}$ miles.

The Menominee River, about 2 miles.

The Kinnickinnick River, about $2\frac{1}{4}$ miles.

Report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Commercial statistics for 1902.—Arrivals of vessels, 5,531; imports, 2,579,157 tons; departures of vessels, 5,596; exports, 1,014,965 tons.

July 1, 1902, balance unexpended	\$255,907.72
June 30, 1903, amount expended during fiscal year	5,479.29

July 1, 1903, balance unexpended	250,428.43
--	------------

July 1, 1903, amount covered by uncompleted contracts	215,000.00
---	------------

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	175,000.00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 12.)

13. *South Milwaukee Harbor, Wisconsin.*—The entrance to this harbor originally varied in depth from absolute closure to about 3 feet, and the harbor was not available for purposes of commerce.

The original project of improvement, and which is the existing project, was adopted in 1896, and provides for a channel 18 feet deep and 200 feet wide between parallel piers. Estimated cost, \$138,000. Published in Annual Report of the Chief of Engineers for 1895, page 2641 et seq.

The total amount expended on existing project up to the close of the fiscal year ending June 30, 1903, is \$4,987.90.

The north pier, originally built by private parties, has been extended 185 feet. No dredging has been done, and the harbor in its present condition is not available for commerce.

A resurvey of this harbor was ordered by act of June 13, 1902. The survey has been made and report thereon will be submitted to Congress in December, 1903.

Commercial statistics for 1902.—There were no arrivals and departures of vessels.

July 1, 1902, balance unexpended	\$207.16
June 30, 1903, amount expended during fiscal year	195.06

July 1, 1903, balance unexpended	12.10
--	-------

Amount (estimated) required for completion of existing project	133,000.00
--	------------

(See Appendix L L 13.)

14. *Racine Harbor, Wisconsin.*—The entrance to this harbor originally varied in depth from absolute closure after storms to about 7 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1842-43, provided for a channel 13 feet deep between parallel piers 160 feet apart. Subsequent modifications provided for extending the piers and increasing the depth of channel to 17 feet.

The amount expended on original and modified projects, prior to operations under present project, is \$336,747.26.

The existing project, adopted by act of March 3, 1899, provides for extending the south pier, building 600 feet of breakwater, and increasing depth in channel to 21 feet. Estimated cost, \$117,650. Published in House Documents No. 326, Fifty-fourth Congress, second session, and No. 165, Fifty-fifth Congress, third session.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$117,881. Of this amount, \$1,591.64 was for maintenance.

The full projected depth in channel has now been secured and the existing project is completed, with the exception of a change in location and direction of breakwater, authorized by act of June 13, 1902.

The maximum draft that could be carried June 30, 1903, was 18 feet. The usual mean annual variation of level of water surface is 0.99 foot.

Connecting with the western terminus of the Government improvement, Root River is navigable for a distance of about nine-tenths of a mile.

The additional work proposed is designed to make access to the harbor easier and safer and for the maintenance of existing works.

The river and harbor act of June 13, 1902, authorized the Secretary of War, in his discretion, to make a survey of the locality with a view to the protection of the harbor against northeast storms, but the local officer has reported that ample information in the way of maps, etc., is available, and a survey has therefore not been ordered. Work intended to accomplish the desired result is now contemplated.

For more extended information and maps, see Annual Reports of the Chief of Engineers for 1896, page 2511, and 1897, page 2768. For reports on examinations and surveys, see House Documents No. 326, Fifty-fourth Congress, second session, and No. 165, Fifty-fifth Congress, third session.

Commercial statistics for 1902.—Arrivals of vessels, 1,684; exports and imports, 554,376 tons.

The commercial statistics indicate that the volume of commerce is quite large and of a general character.

July 1, 1902, balance unexpended	\$21,470.94
Miscellaneous receipts	292.24

	21,763.18
June 30, 1903, amount expended during fiscal year	1,591.64

July 1, 1903, balance unexpended	20,171.54
--	-----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	40,000.00

(See Appendix L L 14.)

15. *Kenosha Harbor, Wisconsin.*—The original depth of water at the mouth of Pike Creek varied from nothing to 4 feet, and the present harbor was not available for purposes of commerce.

The original project, adopted in 1852, provided for a channel 13 feet deep between parallel piers 150 feet apart. Subsequent modifications

provided for extending the piers, increasing the depth of channel to 16 feet, and dredging in the basin.

The amount expended on original and modified projects prior to operations under present project is \$298,012.

The existing project, adopted by act of March 3, 1899, provides for extending the south pier, increasing the width between piers to 250 feet by rebuilding the north pier, building 600 feet of breakwater, and increasing depth in channel and basin to 21 feet and 20 feet, respectively. Estimated cost, \$191,000. Published in House Documents No. 328, Fifty-fourth Congress, second session, and No. 164, Fifty-fifth Congress, third session.

The total amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, not including outstanding liabilities, is \$173,669.09; of this sum \$247.46 was for maintenance.

The full projected depth in both channel and basin has been secured, and the existing project is now completed, with the exception of a change in location and direction of the breakwater, authorized by act of June 13, 1902.

The maximum draft that could be carried June 30, 1903, was 20 feet in the channel and 19 feet in the basin. The usual mean annual variation of level of water surface is 0.99 foot.

Connecting with the western terminus of the Government improvement Pike Creek is navigable for a distance of about 2,500 feet.

The river and harbor act of June 13, 1902, authorizes the Secretary of War, in his discretion, to make a survey of the locality with a view to the protection of the harbor against northeast storms, but the local officer has reported that ample information in the shape of maps, etc., is available and a survey has therefore not been ordered. Work intended to accomplish the desired result is now contemplated.

For more extended information and maps see Annual Reports of the Chief of Engineers for 1893, page 2752; 1897, page 2772; 1900, page 3767; also Appendix L L 15 of this report. For reports on examinations and surveys see House Documents No. 328, Fifty-fourth Congress, second session; No. 164, Fifty-fifth Congress, third session, and No. 46, Fifty-sixth Congress, first session.

The volume of commerce benefited is not very large and is chiefly of a local character.

Commercial statistics for 1902.—Arrivals of vessels, 166; departures of vessels, 166.

July 1, 1902, balance unexpended	\$18, 031. 49
June 30, 1903, amount expended during fiscal year	247. 46
July 1, 1903, balance unexpended	<u>17, 784. 03</u>

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	5, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 15.)

16. *Waukegan Harbor, Illinois.*—Originally there was no navigable channel or natural harbor at this place.

The original project was adopted in 1880, and provided for an artificial harbor of sufficient capacity for local trade by including a portion of

Lake Michigan with pile piers, the entrance channel and inclosed area to be dredged to 13 feet.

The amount expended on original and modified projects prior to commencement of operations under present project was \$218,944.41.

The existing project, adopted by act of June 13, 1902, and published in House Document No. 343, Fifty-sixth Congress, first session, provides for extending both harbor piers, building a breakwater, and increasing depth of channel to 20 feet; estimated cost, \$345,000, of which \$340,000 is appropriated.

The amount expended on the existing project up to the close of the fiscal year ending June 30, 1903, is \$5,473.13, and was applied in furtherance of the same.

The maximum depth that could be carried over the shoalest part of the locality under improvement was about 16.5 feet.

The usual mean annual variation of level of water surface is 0.99 foot.

For more extended information and maps see Annual Report of the Chief of Engineers for 1900, page 3769.

For report on examination and survey see House Document No. 343, Fifty-sixth Congress, first session; also Annual Report for 1900, page 3769.

The commerce of Waukegan is rapidly increasing and is of a general character.

Commercial statistics for 1902.—Arrivals of vessels, 456; imports, 35,097 tons; departures of vessels, 454; exports, 598 tons.

July 1, 1902, balance unexpended	\$101,555.59
Amount appropriated by sundry civil act approved March 3, 1903	240,000.00
	341,555.59
June 30, 1903, amount expended during fiscal year	5,473.13
July 1, 1903, balance unexpended	336,082.46
July 1, 1903, amount covered by uncompleted contracts	302,743.19
{ Amount (estimated) required for completion of existing project	5,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$5,000.00
For maintenance of improvement	8,000.00
	13,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix L L 16.)

17. *Fox River, Wisconsin.*—The Fox and Wisconsin rivers, separated at Portage, Wis., by a distance of only 2 miles, one flowing into Lake Michigan, the other into the Mississippi River, were the early means of communication between those waters. In 1846 Congress granted to the State of Wisconsin a quantity of land for the purpose of improving the navigation of this route. By means of a board of public works the State began and carried on the improvement until 1853, when it was transferred to a private company. In 1872 the United States acquired possession of the property, with the exception of the water power, water-power lots, and personal property. The earliest project, that of 1848, called for canals 40 feet wide at bottom and 4 feet deep, with locks 125 feet long and 30 feet wide. This project was enlarged subsequently. The present project is that of a Board

of Engineers submitted September 17, 1884, and modified May 14, 1886. It provides for deepening and widening the channel of the Fox River from Green Bay to Montello to 6 feet depth and 100 feet width and from Montello to Portage to 4 feet depth, and for the renovation of 12 old locks.

The improvement of the Wisconsin River was abandoned in 1887.

The amount expended on the Fox and Wisconsin rivers from 1867 to the close of the fiscal year ending June 30, 1903, including \$145,000 paid to the Green Bay and Mississippi Canal Company for its property, was \$3,096,517.65, of which amount \$431,517.65 was appropriated solely for and expended solely upon the Fox River since 1885.

The result of this expenditure upon the Fox River was the construction of 17 new stone locks, 10 composite locks, 16 permanent dams, 13 canals, a head wall and feeder at the old first lock at Appleton, a lock house at Appleton, warehouse at Appleton first lock and Berlin lock, a wing dam and brush and stone shore protection to the Portage levee, masonry waste weirs at Little Chute combined locks, and Appleton third lock, masonry culvert at head of Little Chute combined locks, a dry dock at Kaukauna, guard gates at head of Kaukauna Canal; also rebuilding canal banks at Kaukauna, wing walls at Kaukauna fourth lock, and 1,237 linear feet of cement-laid rubble-core wall in canal banks of fourth and fifth levels. A channel 75 feet wide and 450 feet long has been secured by blasting and drilling the rock bar below Depere lock from 4 to 12 inches below the top of the lower miter sill. Channel below Depere has been deepened, and channel deepened at mouth of Fond du Lac River, Neenah channel, Fox River at head of Lake Butte des Morts, Grignon Rapids, below Little Chute and Rapide Croche locks, and in the canals and upper Fox River. Masonry outlet to waste weir at Kaukauna second lock, a roadway upon the United States property at Appleton first lock, and fishways in the Eureka, Berlin, White River, Princeton, Grand River, Montello, and Fort Winnebago dams have been constructed. A harbor of refuge has been constructed at Stockbridge Landing, Lake Winnebago, snags have been removed and bars dredged in Wolf River, making a 4½-foot channel 100 feet wide to New London, and harbor at Miller Bay, Lake Winnebago, improved.

The full depth of 6 feet has now been obtained from Depere to White River lock. Above this point the projected depth and width have not been obtained.

The expenditures during the fiscal year ending June 30, 1903, were for dredging channel upper Fox, improving Miller Bay, Lake Winnebago, and repairs of dredging plant.

The relative value of the commerce involved and the cost of the improvement can not be estimated.

Its principal effect so far has been to cause some reduction in freight rates to points in the Fox River Valley. Deepening the channel of the upper Fox River by dredging has also had, and will continue to have, the effect of draining the enormous expanse of meadow lands in the Fox River Valley and greatly increasing their availability and value.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the improvement was 6 feet from Depere to White River lock, and from that point 3½ feet to Portage, the head of navigation on the Fox River.

July 1, 1902, balance unexpended	\$76,685. 99
Miscellaneous receipts	453. 09
June 30, 1903, amount expended during fiscal year	77, 139. 08
	3, 433. 64
July 1, 1903, balance unexpended	73, 705. 44
July 1, 1903, outstanding liabilities	1, 100. 02
July 1, 1903, balance available	72, 605. 42
{ Amount (estimated) required for completion of existing project	145, 886. 48
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	60, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix L L 17.)

18. *Operating and care of locks and dams on Fox River, Wisconsin.*—Under an allotment from the indefinite appropriation for operating and care of canals and other works of navigation there has been expended during the year ending June 30, 1903, the sum of \$68,482.59.

The principal work has been dredging bars and channels; making repairs of locks, dams, canal banks, lock houses, dredges, and boats; rebuilding gates and repairing floors of Grand River and White River locks; rebuilding gates of Princeton and Little Chute combined locks; rebuilding Kaukauna second lock with cut-stone masonry; building shore protections to sand banks upper Fox River, and care of works and property.

A detailed statement, appended to the report of the local engineer officer in charge, shows the items of expenditures.

Navigation was closed November 26, 1902, and reopened April 10, 1903. The water in Lake Winnebago and the lower Fox has been maintained at the crests of the dams throughout the year, with the exception of Lake Winnebago during the close of navigation, drawn down by the mills with permission of the Secretary of War.

For commercial statistics see report of the local officer upon improvement of Fox River, Wisconsin.

(See Appendix L L 18.)

IMPROVEMENT OF CHICAGO AND CALUMET HARBORS, ILLINOIS, OF CHICAGO RIVER, ILLINOIS, AND OF CALUMET RIVER, ILLINOIS AND INDIANA; SURVEY OF ILLINOIS AND DES PLAINES RIVERS, ILLINOIS, FOR WATERWAY FROM LOCKPORT, ILL., TO ST. LOUIS, MO.

This district was in the charge of Col. O. H. Ernst, Corps of Engineers.

1. *Chicago Harbor, Illinois.*—The present project was adopted in 1870 and modified in 1878, and contemplated—

(a) The formation of an outer harbor by inclosing a portion of Lake Michigan just south of the entrance to Chicago River by breakwaters and dredging the same for the purpose of increasing the harbor facilities of Chicago.

(b) The construction of an exterior breakwater in deep water in Lake Michigan, north of the entrance to Chicago River and about 1 mile distant therefrom, to shelter the approaches to the river and outer harbor and to form a harbor of refuge near the southern end of Lake Michigan.

(c) To keep the entrance to Chicago River dredged for the passage of vessels navigating the Chicago River as far as to the original shore line of Lake Michigan at or near Rush Street Bridge.

The river and harbor act of March 3, 1899, further modified the project of 1870 by providing for dredging the outer basin and harbor entrance to 20 feet depth at low water.

There has been expended upon this project up to June 30, 1903, \$1,908,478.22.

All the work under the projects of 1870 and 1878 has been completed except dredging the outer basin.

A contract was in force at the beginning of the year for dredging the Chicago River from Rush street eastward, for removing the bar at the entrance to the river, and for dredging the inner harbor or basin so far as the funds would permit. Work under this contract began May 2, 1901, and was completed December 6, 1902, an aggregate of 1,153,087 cubic yards being removed, resulting in a 21-foot channel in the river from the Rush Street Bridge to the lake, and the same depth over the bar at the harbor entrance, and over an anchorage ground extending southwardly from the river a distance of 3,000 feet for a width of about 1,150 feet, comprising an area of about 79 acres.

July 1, 1902, balance unexpended	\$39,600.72
June 30, 1903, amount expended during fiscal year	37,157.78
July 1, 1903, balance unexpended	2,442.94

Amount (estimated) required for completion of existing project	409,960.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	295,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 1.)

2. *Chicago River, Illinois.*—This river, as far as its navigable water extends, is entirely within the limits of the city of Chicago, Ill. Prior to the fiscal year ending June 30, 1896, no work had been done for the improvement of its navigation by the United States. The project inaugurated by Congress under the act of June 3, 1896, as modified by the act of June 4, 1897, contemplated the improvement of the river by dredging and minor changes of docks and dock lines to admit passage by vessels drawing 16 feet of water. It may be considered that this project was completed with the fiscal year ending June 30, 1902, at which time there had been expended \$423,520.51, exclusive of \$25,000 allotted from the act of August 18, 1894, for the improvement of Chicago Harbor, Illinois. As a result of this expenditure the river was dredged to a depth of 17 feet below Chicago city datum from the mouth of the river to Ashland avenue on the South Branch and West Fork, and to the stock yards on the South Fork, South Branch, a distance of about 6 miles, and to Belmont avenue on the North Branch, the head of navigation. The lands removed under the project for widening and deepening the river were secured at a cost of \$91,949.50. The total amount of material removed was 1,998,561 cubic yards. There has been some shoaling since the project was completed.

By the act of June 13, 1902, Congress provided for two turning basins, the project for which was approved August 18, 1902, the estimated cost being \$500,000. Two tracts of land for this purpose have been acquired at a cost of \$155,503.57, one tract has been ceded by the

State of Illinois, and 19 remain to be secured before the construction of the basins can be begun.

There has been expended upon this project to June 30, 1903, \$162,613.08.

July 1, 1902, balance unexpended	\$507, 954. 61
June 30, 1903, amount expended during fiscal year	162, 613. 08

July 1, 1903, balance unexpended	345, 341. 53
--	--------------

(See Appendix M M 2.)

3. *Calumet Harbor, Illinois.*—This harbor is known on the Great Lakes as South Chicago Harbor.

This improvement was designed to furnish a safe and practicable entrance to Calumet River and the port of South Chicago by the construction of parallel piers 300 feet apart, projecting from the shore into Lake Michigan, and by dredging between them.

The work began in 1870, and all the projected work had been accomplished for a 16-foot draft prior to June 30, 1896, resulting in the construction of 3,640 linear feet of north pier and 2,020 linear feet of the south pier, and securing and maintaining a channel 16 feet deep and of suitable width from water of similar depth in Lake Michigan to the Calumet River at the roots of the piers, at a cost of \$454,483.53. The work included also 476,564 cubic yards of material dredged, increasing the depth in the channel from 7 to 16 feet.

On June 30, 1896, it may be considered that the original project for this locality was completed.

Under date of February 21, 1896, a plan for improvement of both the inner and outer harbors was submitted. The estimated cost of this improvement was \$1,134,830. (Annual Report of the Chief of Engineers for 1896, p. 2583.)

The expenditures to June 30, 1903, were \$1,083,210.93.

Under the project of February 21, 1896, for construction of the outer harbor of refuge, adopted by Congress in the river and harbor act of March 3, 1899, and modified in the act of June 13, 1902, work was in progress under contract at the close of the fiscal year, and the following had been accomplished:

(a) A breakwater built 4,400 feet long, connected with the shore and running due east into the lake, terminating in water 32 feet deep.

(b) An extension of this breakwater contracted for, 2,500 feet long, in a southeasterly direction from the end of the first, a portion of the stone placed for foundation and one crib built but not sunk.

(c) The anchorage area sheltered by breakwater dredged to 21 feet depth except about 13 acres, 1,233,211 cubic yards of material being removed.

(d) South pier at the mouth of Calumet River extended 800 feet.

(e) The Calumet River dredged to a width of 200 feet and depth of 21 feet for a distance of 2 miles from the mouth.

(f) The shore end of the north pier rebuilt for a distance of 453 feet.

July 1, 1902, balance unexpended	\$486, 986. 02
Amount appropriated by sundry civil act approved March 3, 1903	204, 480. 00

	691, 466. 02
June 30, 1903, amount expended during fiscal year	227, 445. 95

July 1, 1903, balance unexpended	464, 020. 07
--	--------------

(See Appendix M M 3.)

4. *Calumet River, Illinois and Indiana.*—The project for the improvement of this river, adopted by Congress in 1884 and modified in 1886, contemplated securing a channel 200 feet in width and 16 feet in depth below low water in Lake Michigan, from the mouth of Calumet Harbor, Illinois, to one-half mile east of Hammond, Ind.

The project was modified by the river and harbor act of June 3, 1896, so as to provide for dredging the channel for 2 miles southward from the mouth of the river to 20 feet depth.

Under the project of 1884 there was dredged a channel, measured from the harbor southward, to the full width of 200 feet and depth of 16 feet, 19,518 feet in length, except that over a short portion where rock was encountered the width was reduced to 85 feet and the depth to 14 feet.

In addition there was removed 248,516 cubic yards of material from the channel between "The Forks," and one-half mile east of Hammond, Ind., in an effort to secure a practicable channel 10 feet deep and 60 feet wide, resulting in failure, due to rapid refilling of channel.

Under the supplementary project of 1896 there had been 320,405 cubic yards of material removed under contract, completing the channel 20 feet deep a distance of 2 miles, and providing a winding or turning basin 20 feet deep at the first cut-off above the mouth of the river.

Winding or turning basins should be provided at intervals of from 1 to 2 miles along the river.

The expenditures to June 30, 1903, amounted to \$402,638.78.

The river and harbor act of June 13, 1902, appropriated \$75,000 for the improvement of this stream, and provided for an extension of the 20-foot channel from One hundred and sixth to One hundred and twenty-second streets, a distance of 2.2 miles, and for the resumption of the work above "The Forks." The officer in charge points out that no useful results can be obtained from expenditures above "The Forks."

A contract for dredging the river to a depth of 20 feet from One hundred and sixth street to One hundred and tenth street, and to 14 feet depth from One hundred and eighteenth street southwardly as far as available funds will permit, was approved March 20, 1903, but no work had been done at the close of the fiscal year.

It is expected that report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$85,017.14
June 30, 1903, amount expended during fiscal year	2,655.92

July 1, 1903, balance unexpended	82,361.22
--	-----------

{ Amount (estimated) required for completion of existing project	423,822.50
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	250,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix M M 4.)

5. *Survey of Illinois and Des Plaines rivers, Illinois, for waterway from Lockport, Ill., to St. Louis, Mo.*—Under the provisions of

that part of the river and harbor act of June 13, 1902, making an appropriation of \$200,000 for this work, of which amount \$175,000 is available for surveys, etc., above the mouth of the Illinois River, a Board of Engineer officers, consisting of Col. O. H. Ernst, Lieut. Col. Charles J. Allen, and Maj. Thomas L. Casey, was appointed by Special Orders, No. 19, headquarters Corps of Engineers, July 5, 1902.

A large survey party, subdivided into triangulation, precise-level, topographical, and hydrographical parties was organized and put into the field in October and November, 1902. The survey was begun at the mouth of the Illinois River and has progressed upstream to the neighborhood of Pekin, Ill., a distance of about 150 miles.

It is expected that the survey will be completed during the working season of 1904.

July 1, 1902, balance unexpended	\$175,000.00
June 30, 1903, amount expended during fiscal year	47,539.15
July 1, 1903, balance unexpended	127,460.85

(See Appendix M M 5.)

IMPROVEMENT OF ILLINOIS RIVER, ILLINOIS, AND CONSTRUCTION OF ILLINOIS AND MISSISSIPPI CANAL.

This district was in the charge of Maj. J. H. Willard, Corps of Engineers. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. Illinois River, Illinois.—The project, which contemplates the extension of slack-water improvement begun by the State of Illinois from Copperas Creek locks to the Mississippi River, and which includes the construction of two locks 350 feet long between sills, 75 feet width of chamber, with 7 feet of water over sills at low-water level of 1879, and dredging the channel where necessary to obtain 7 feet depth at low water, was adopted in 1880.

The United States has expended on this work up to June 30, 1903, \$1,455,769.73, of which \$10,171.93 was expended during the fiscal year in maintenance of plant and care and repair of property. Active operations were practically suspended during the past year on account of the exceptionally high water prevailing during the season of 1902 and the spring of 1903.

The lock and dam at Kampsville, Ill., 31 miles above the mouth of the Illinois River, has been completed and in use since 1894; and that at Lagrange, 79 miles above the mouth, since 1890.

The State of Illinois, aided by the United States, has executed part of the general project by the construction of locks and dams at Henry and at Copperas Creek, completing, except dredging, that part of the project between Lasalle and the mouth of Copperas Creek, a distance of about 90 miles, over which section the State of Illinois collects tolls.

July 1, 1902, balance unexpended	\$90,775.41
June 30, 1903, amount expended during fiscal year	10,171.93
July 1, 1903, balance unexpended	80,603.48
July 1, 1903, outstanding liabilities	500.00
July 1, 1903, balance available	80,103.48

Amount (estimated) required for completion of existing project 182,000.00

(See Appendix N N 1.)

2. *Operating and care of Lagrange and Kampsville locks, Illinois River, and approaches thereto.*—These locks and dams have been operated and maintained under the indefinite appropriation provided for in section 4 of the river and harbor act of July 5, 1884.

(a) *Lagrange lock and dam.*—Navigation continued by this lock the entire year, except in January. In July and August, 1902, and in the spring of 1903 many of the boats passed over the dam. The number of steamboats and barges passing this lock was somewhat greater than for the preceding year.

Five thousand nine hundred and two dollars and sixty-five cents was expended during the past year.

(b) *Kampsville lock and dam.*—There was no navigation through this lock from December 20, 1902, to March 9, 1903. During July and August, 1902, and March, April, May, and June, 1903, most of the boats passed over the dam. During the remainder of the year the lock was used. The number of boats passing this lock was about equal to that for the preceding year.

The expenditures during the past year amounted to \$5,508.81.

(See Appendix N N 2.)

3. *Illinois and Mississippi Canal, Illinois.*—The object of the improvement is to furnish a link in a navigable waterway from Lake Michigan to the Mississippi River at the mouth of Rock River, Illinois.

The canal has been located on the Rock Island route, approved by the Secretary of War October 27, 1888, as directed in the act of Congress of August 11, 1888. It proceeds from the Illinois River at its great bend, $1\frac{1}{2}$ miles above the town of Hennepin, Ill., thence via Bureau Creek Valley and over the summit to Rock River at the mouth of Green River, thence by slack water in Rock River and a canal around the lower rapids of the river at Milan to the Mississippi River at the mouth of Rock River.

The canal is to be at least 80 feet wide at the water surface, 7 feet deep, and with locks 170 feet long and 35 feet width of lock chamber, capable of passing barges carrying 600 tons (maximum) freight.

A report upon the location, with detailed estimates of cost, of this canal was submitted June 21, 1890, and published (without maps) as House Executive Document No. 429, Fifty-first Congress, first session, and is also printed in the Annual Report of the Chief of Engineers for 1890, page 2586.

The river and harbor act of September 19, 1890, made the first appropriation for the construction of the canal, and directed work to be begun by the construction of one of the locks and dams in Rock River.

In accordance with this act work was begun in July, 1892, near the mouth of Rock River, on the construction of a canal around the lower rapids of the river, and since that date has been prosecuted as rapidly as the appropriation of funds permitted. The survey work in locating the canal on the ground, and proceedings for acquiring title to the right of way, have been continuous since October, 1890, and the canal has been definitely located on the ground throughout its entire extent.

There had been expended on this work up to the close of the fiscal year ending June 30, 1903, \$5,446,265.87.

The result of this expenditure has been:

First. The acquisition of the right of way for $4\frac{1}{2}$ miles around the lower rapids of Rock River and the completion of $4\frac{1}{2}$ miles of canal

there, involving the construction of $4\frac{1}{2}$ miles of earthwork in constructing the canal trunk, 3 locks, 1 railroad and 2 highway swing bridges, 7 sluiceways and gates, 1 arch culvert, 2 dams 1,392 feet long across the arms of Rock River, 3 lock keepers' houses, 1 small office building, a thorough riprapping of the canal banks (not estimated for in the original estimates), and construction by contract of Moline wagon bridge at a cost of \$25,000, which was also not included in the original estimate.

Second. In the location on the ground and preparation of descriptions, plats, and abstracts of title of all lands needed for the construction of the canal and feeder, and for lands to be overflowed or damaged by the canal at Sterling.

Third. In the completion on eastern section of all earthwork miles 1 to 18, and practical completion of earthwork miles 19, 20, and 24 to 28, inclusive; the foundations and masonry for all culverts and locks 1 to 21; the construction of 3 aqueducts, 11 highway and 3 railroad bridges, 9 arch culverts and 11 pipe culverts; construction of abutments for 7 additional highway bridges, the superstructures of which are in course of erection at close of the fiscal year; the erection of 5 houses for superintendents and 1 small house for office use, and acquiring additional right of way for waste material, miles 21 to 23, inclusive.

Fourth. In the acquisition, by condemnation or purchase, of all lands required for the canal, except a small amount required for bridge approaches, drainage outlets, and to avoid damage claims by reason of drifting sands.

Fifth. In the construction of 4,673,008 cubic yards of earthwork on the feeder, completing all work of that character, except some cross banks and bridge approaches; completion of 9 arch and 10 pipe culverts; foundations and abutments for 7 highway and 2 railway bridges, and the superstructure of 1 double-track highway and 2 single-track railway bridges; excavation of 75,000 cubic yards of rock in mile 1, and the distribution of the same in the form of riprap along the interior slopes of the feeder; the construction of the masonry of the lock, sluiceways, and abutments for the headworks of the feeder.

Sixth. In the acquiring of lands for the right of way, including land to be damaged by overflow and land upon which to deposit waste material on the western section; construction of 2,831,013 cubic yards of earthwork, completing 17 miles and 60 per cent of 6 miles more; 6 arch and 17 pipe culverts; placing under contract foundations for 4 arch culverts, 2 locks, and 4 aqueduct bridges, also the letting of contract for constructing foundations for 5 locks and 1 aqueduct bridge, walls for 8 locks, piers and abutments for 5 aqueduct bridges and 1 highway bridge; completing masonry of all highway bridges, except 2 on the western section; letting contract for 19 highway and 1 double-track railway bridges; completing the foundations of 3 arch culverts and for 3 locks, and building 8 warehouses and 3 lock houses.

The excessive rainfall during the past fiscal year has impeded the canal work to a considerable extent, and has also rendered it necessary to make expenditures for protecting and repairing the finished work. The same cause has forced the suspension of operations under many of the contracts for earthwork on the western section and rendered it impossible to prosecute work in the lock pits and foundations. Under these conditions the contractors have been allowed additional time and it is believed they will succeed in completing their contracts, except

in the case of Charles Stone, who has apparently abandoned work under his contract for excavating pits and constructing foundations for abutments and piers for 4 aqueduct bridges, and it will probably have to be relet at the expense of his bondsmen.

July 1, 1902, balance unexpended	\$1, 880, 633. 21
June 30, 1903, amount expended during fiscal year	380, 152. 62
July 1, 1903, balance unexpended	1, 500, 480. 59
July 1, 1903, outstanding liabilities	20, 000. 00
July 1, 1903, balance available	1, 480, 480. 59
July 1, 1903, amount covered by uncompleted contracts	582, 629. 53
(See Appendix N N 3.)	

IMPROVEMENT OF MICHIGAN CITY HARBOR, INDIANA, AND OF RIVERS AND HARBORS ON THE EAST SHORE OF LAKE MICHIGAN.

This district was in the charge of Capt. Charles Keller, Corps of Engineers, to March 14, 1903; in the temporary charge of Maj. J. G. Warren, Corps of Engineers, from March 14 to April 30, 1903, and in the charge of Lieut. Col. M. B. Adams, Corps of Engineers, from April 30 to June 30, 1903. Division Engineer, Col. O. H. Ernst, Corps of Engineers, to April 30, 1903.

General statement as to the usual variations in the level of the lake surface at all the harbors on the east shore of Lake Michigan.—The level of the lake service varies considerably from time to time. At present its maximum height may be stated as from 0.5 to 1 foot below mean low water, and obtains from the end of June to the middle of August. Its lowest stage is between 1.5 and 2 feet below mean low water, and obtains with slight change from early in November to early in April.

Construction of dredge.—Bids for construction of a dredge for use at localities in this district have been invited. Details concerning the same are given in Appendix I 6, herewith.

1. *Michigan City Harbor, Indiana.*—The inner and outer harbors were formerly separate works. They are now consolidated in consequence of the requirements of the river and harbor act of June 13, 1902.

The improvement of this harbor dates from 1836, and has resulted in establishing an inner harbor for local commerce and partly completing an outer harbor, designed to facilitate entrance to the former and afford refuge for vessels engaged in general lake commerce.

The inner harbor.—This has been made by deepening the entrance to Trail Creek and protecting the channel by piers extending to deep water in Lake Michigan, to which operations were limited until 1870. The original depths before improvement were 9 feet upon the outer bar and 3½ feet or less at the entrance to the inner harbor, and the width varied from 175 feet in the lower portion to 60 feet or less in the upper portion. Since 1882 the entrance channel has been prolonged up the creek by dredging between revetments, as they are built on established wharf lines at the expense of the adjoining property owners, as required by city ordinance. No general project for the expenditure of funds has been definitely adopted, but it seems to have been agreed that the improvement should extend upstream between banks revetted, as previously described, as far as the Lake Erie and Western Railroad bridge.

A map of this portion of Trail Creek is given opposite page 2270, Annual Report of the Chief of Engineers for 1882.

In recent years the project has been purely one for maintenance, and has resulted in creating, by dredging, a channel 9,159 feet long between revetments from 100 to 175 feet apart, except at the turning basins, where the width is about 330 feet. The upper limit of this improved channel is 100 feet above the upper turning basin in the map above referred to, but above the lower part of the upper basin the channel has shoaled and is not available for lake vessels.

The total expenditure to June 30, 1902, was \$438,365.50. Of this total, \$287,383.77 was expended from 1836 to 1869, inclusive, principally upon pier construction, but it is now impossible to separate the cost of maintenance for this period from that of original construction. Since 1869, \$150,981.73 in all has been expended, of which \$54,419.55 was applied to maintenance.

On June 30, 1903, there was a channel depth of 14.7 feet from the harbor entrance to the lower basin, a distance of about 5,500 feet, above which point the depth gradually decreased to 10.4 feet at the upper basin. The maximum draft which can be carried over the shoalest point in the improved channel to the lower basin was, on June 30, 1903, 14.7 feet, and above that, 13 feet to the second angle above the Sixth Street Bridge.

The commerce benefited by the improvement is purely local in character, the principal business being in lumber and salt, which are brought from the northern harbors by small steam barges and by sailing vessels.

The channel does not maintain itself and provision should be made for periodical dredging.

The outer harbor.—Michigan City, being at the southern end of the lake, is exposed to northerly storms, especially those from west of north, with a clear sweep of the length of the lake, about 250 miles. As a result, there arose a demand for a harbor of refuge in this vicinity, which was answered in 1870 by the adoption of a project for the creation of an outer harbor at this place, which was to consist of an outer basin east of the entrance to the inner harbor. In 1882 this project was extended to include the construction of an exterior breakwater northwest of the entrance. The piers and breakwaters covering the outer basin were completed in 1885, and have a total length of 3,171 feet measured on the harbor face, viz, a pile pier 1,225 feet long extending in a northerly direction from the shore and closing the basin on the east; a crib breakwater, 1,411 feet long, extending westward from the lake end of the pile pier and closing the basin on the north, and a crib pier, 535 feet long measured from the angle in the harbor face, or 505 feet measured from the rear face of the breakwater, extending northward from the west end of the crib breakwater. The exterior breakwater contemplated by the project of 1882 was to have a total length of 2,000 feet, but a length of only 700 feet had been built.

The river and harbor act of March 3, 1899, authorized the adoption of the project of a Board of Engineers as printed in the Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, inclusive, and provided for the completion of the work under the continuing-contract system. This project requires the extension of the breakwater pier by 600 feet, the construction of a new detached breakwater 1,500

feet long, and the removal of the present detached breakwater. The estimated cost of the work was given at \$282,150, but it is now found necessary to increase this estimate by \$30,000, making the total estimated cost of the work \$312,150.

Up to June 30, 1903, the sum of \$934,993.48 had been expended upon the original project and its subsequent modifications. Of this amount \$758,226.34 had been expended upon the projects of 1870 and 1882, of which \$132,665.25 was applied to maintenance; and \$176,767.14 had been expended upon new construction under the revised project.

The Annual Report of the Chief of Engineers for 1897, pages 2899 to 2904, contains the full report of the Board of Engineers referred to above, and a map showing the outlines of the present project is opposite page 2904 of this report.

During the past year work has progressed under the continuing contract for the extension of the breakwater pier and the construction of the new detached breakwater.

The increased quantity of stone required for the foundation of the cribs in the detached breakwater made it necessary to reduce the length of the breakwater to be built, and supplementary articles of agreement were entered into February 27, 1903, reducing the length from 1,400 to 1,300 feet.

A contract for repairing the entrance piers and closing the entrance to the outer basin was made under date of February 27, 1903. Operations under this contract were commenced April 21, 1903.

The district officer reports that to complete the approved project will require the further appropriation of \$30,000, to be used in constructing 200 linear feet of detached breakwater.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	1, 153	208, 617	1896.....	437	106, 543
1889.....	796	169, 193	1897.....	492	118, 137
1890.....	921	172, 817	1898.....	478	127, 237
1891.....	837	168, 654	1899.....	601	144, 860
1892.....	1, 391	443, 055	1900.....	412	102, 323
1893.....	1, 577	589, 863	1901.....	502	121, 806
1894.....	389	119, 929	1902.....	877	269, 416
1895.....	343	91, 016			

NOTE.—No record is kept of traffic between Michigan City and Chicago.

July 1, 1902, balance unexpended\$272, 197. 89
Miscellaneous receipts 4, 100. 00

276, 297. 89

June 30, 1903, amount expended during fiscal year 106, 393. 10

July 1, 1903, balance unexpended 169, 904. 79

July 1, 1903, outstanding liabilities 318. 44

July 1, 1903, balance available 169, 586. 35

July 1, 1903, amount covered by uncompleted contracts..... 144, 545. 74

{ Amount that can be profitably expended in fiscal year ending June 30, 1903, for maintenance of improvement, in addition to the balance available July 1, 1903..... 45, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix C C 1.)

2. *St. Joseph Harbor and River, Michigan.*—These were formerly carried as separate works, but are now combined in consequence of a provision in the river and harbor act of June 13, 1902.

(a) *St. Joseph Harbor.*—This harbor is formed by the junction of the St. Joseph and Pawpaw rivers and extends along the city front of St. Joseph, and in its original condition had a natural width of 800 feet, which has been reduced to 300 feet by wharves built upon the approved harbor lines. It has been under improvement by the United States since 1836, previous to which time there was a narrow and crooked channel with depths which varied from 3 to 7 feet. The original project of 1836 is not clearly known. Up to 1866 there were built 1,100 feet of north pier and 212 feet of south pier, which protected a cut through the narrow tongue of land to the north of the old river mouth, the width between the piers being 240 feet, which became 257 feet through subsequent repairs. In all \$162,113 was expended upon this work. In 1866 the first definitely known project was adopted, and this proposed the extension of the south pier 200 feet for the purpose of facilitating the creation of a direct channel of 16 feet depth through the bar at the entrance. The project of 1866 was modified in 1874, 1875, 1880, and 1892, the changes having reference principally to the length and direction of the two piers. The Benton Harbor Canal, which is about 1 mile long and extends from the upper part of the harbor to the town of Benton Harbor, was taken over by the United States for the purpose of care, maintenance, and improvement. In all there was expended upon these various projects \$503,113.23.

The river and harbor act of March 3, 1899, adopted the present project, which is printed in the Annual Report for 1898, pages 2496–2498. This project provides for an entrance channel 18 feet deep and for an interior channel 18 feet deep and 150 feet wide along the city front of St. Joseph, while the Benton Harbor Canal and the turning basin at the mouth of the St. Joseph River are to be dredged to 15 feet. The north pier is to be extended 1,000 feet, and the south pier, upon a line parallel to the north pier, 1,800 feet. The width between will be 330 feet at the entrance, narrowing to 257 feet inside. The estimated cost of completion of the existing project was given in the above report at \$380,000. Up to June 30, 1903, there had been expended upon the existing project \$259,606.76, of which \$17,638.70 had been applied to the repairs of the south pier provided for by the project. Operations since June 25, 1900, have been in progress for the purpose of completing all the work contemplated. As a result of the above expenditures 1,000 feet had been added to the north pier and 1,800 feet to the south pier, and in November, 1901, the proposed dredging had been completed so far as practicable. Deterioration in the dredged channels has since taken place. The bar just beyond the ends of the piers still persists and limits the maximum through draft to 16.6 feet. To complete the existing project the dredging through this bar still remains to be done, and annual dredging will be required.

The north pier and revetment measure 2,854 feet, 2,183.5 feet being crib work and 670.5 feet pile work. At the east end a wing 165 feet long connects it with the dock of the United States light-house depot. The south pier is 2,620 feet long, 1,800 feet being crib work and 820 feet pile work. Upon the completion of the contracts now in force all these structures will be in excellent condition except the 165 feet of wing at the east end of north pier.

Early in March it was found that a bar with only 3 feet of water in the middle of the channel had formed in the Benton Harbor Canal at the mouth of the Pawpaw River. The steamer *Soo City*, of the Graham & Morton Transportation Company, removed this obstruction by scouring a channel through it so as to afford a channel with a central depth of 14 feet.

Soundings made April 18-23, 1903, showed the following available depths: 22 feet outside the entrance, 17.3 feet on the shoal between the ends of the piers, 17 feet on the best course between the piers, 15 feet above the railroad bridge, and 14.5 feet in the Benton Harbor Canal. The soundings show considerable shoaling of the channels since the general dredging operations in 1901. The accretions causing this deterioration are due to sand brought down by the St. Joseph and Pawpaw rivers during floods, and, as this is a matter of annual recurrence, dredging for the restoration of the channel may be expected to be required from year to year. The cost of this dredging is estimated at \$10,000 per year, or for two years, \$20,000. The estimate for St. Joseph River is \$750, making an aggregate estimate of \$20,750.

The principal traffic benefited by this improvement is the fruit traffic and the carrying of passengers, including excursionists to the summer resorts in this vicinity. Both classes of traffic show continuous growth. The entire traffic is served by a single line of steamers, which, however, during the summer, runs from two to four boats daily, some of these being of very great size.

House Document No. 307, Fifty-fifth Congress, second session, reproduces a map accompanying the present revised project, which is not republished in the Annual Report of the Chief of Engineers for 1898.

(b) *St. Joseph River*.—This is a crooked stream, obstructed by numerous shoals, with depth in channel crossings of from 24 to 30 inches. The intervening pools are generally from 4 to 8 feet deep. The part under improvement is from the mouth, at St. Joseph, to Berrien Springs, a distance of about 25 miles by river. The improvement of this section to make a low-water channel 3 feet deep has been in progress since 1889, and consists in removing snags and logs and closing secondary channels, or concentrating the flow at other critical points by dams of brush, logs, and stone.

The amount expended to June 30, 1903, was \$5,500, as a result of which many of the worst places of the stream had been improved to the required extent.

There were no operations in progress during the past year.

The average annual expenditure has been \$500. Experience shows that this is too little to accomplish what is desired.

The traffic benefited by this improvement is a limited one, two small steamers being employed to carry passengers (almost exclusively summer tourists) and a small quantity of freight, which is principally fruit.

Entrances and clearances.

Calendar year.	Vessels entered.		Vessels cleared.	
	Number.	Tonnage.	Number.	Tonnage.
1890	948	131,607	946	131,395
1891	742	215,334	713	215,591
1892	1,726	707,285	1,727	707,785
1893	1,576	1,125,063	1,575	1,125,938
1894	1,100	900,000	1,100	900,000
1895	779	327,384	727	327,837
1896	835	439,031	833	435,033
1897	842	385,915	849	348,040
1898	948	1,216,567	913	1,114,560
1899	853	446,178	851	430,411
1900	940	453,543	934	442,419
1901	835	389,679	837	395,100
1902	854	413,782	851	412,388

July 1, 1902, balance unexpended ^a\$237,295.25
 Miscellaneous receipts 500.00

June 30, 1903, amount expended during fiscal year 237,795.25
 140,425.89

July 1, 1903, balance unexpended 97,369.36
 July 1, 1903, outstanding liabilities 405.71

July 1, 1903, balance available 96,963.65

July 1, 1903, amount covered by uncompleted contracts 74,215.94

{ Amount that can be profitably expended in fiscal year ending June
 30, 1905, for maintenance of improvement, in addition to the balance
 available July 1, 1903. 20,750.00
 Submitted in compliance with requirements of sundry civil act of June
 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 2.)

3. *South Haven Harbor, Michigan.*—This harbor is situated at the mouth of Black River. Improvements were begun in 1867, at which time there existed a channel 7 feet deep and 85 feet wide between slab piers. These piers had been built by residents of the vicinity at a cost of about \$18,000. The banks of the river for 500 feet on each side had a rough protection of close piling.

The existing project is that of 1866 as modified in 1869, 1872, and 1888, and provides for constructing parallel piers and revetments 175 feet apart at the mouth of Black River, with the object of procuring a channel 12 feet deep, and to extend the navigable channel one-half mile up Black River to the highway bridge by dredging.

The total expenditure to June 30, 1903, was \$307,600.23, of which \$120,367.40 had been applied to maintenance by dredging and repair of existing structures. During the past year the harbor has been dredged, repairs made to outer end of north pier where damaged by steamer *City of Kalamazoo* on June 7, 1902, and the south revetment repaired where damaged by steamer *Petoskey* on September 22, 1902.

Deterioration of the dredged channels is rapid on account of the insufficient length of the piers. Soundings made April 1–8, 1903, showed the following available depths: On the outer bar, 13.4 to 14.6 feet; between the piers, 12 to 13 feet; and above the Government re-

^a This is an increase over the balance reported last year of \$47.20, being the amount of a deposit made August 5, 1893, and not hitherto taken up.

vetment, 12.4 feet. Dredging operations in May, 1903, increased these depths as follows: On the outer bar, 18 feet; between the piers, 16 feet; and a single cut 30 feet wide and 16 feet deep was made within the Government revetments as far as the winding basin, a distance of 2,090 feet. This cut was widened at both ends for greater ease in entering it.

As is the case with most of the harbors in this vicinity, the principal traffic of South Haven depends upon the fruit crops and the summer-resort and excursion travel from Chicago. The business of the harbor has, however, been increasing rapidly for the past two years, and lately, in addition to the usual Chicago service, a service to Milwaukee, in connection with the Michigan Central Railroad, has been started. The steamers now in use do not exceed 12 feet in draft, but the demand is for larger vessels, and to permit their use the piers should be extended.

Report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1889 (estimated)	1,080	.....	1896	1,218	343,016
1890	2,246	128,880	1897	1,256	351,000
1891	2,994	201,380	1898	771	322,620
1892	3,060	212,160	1899	682	276,117
1893	3,822	251,730	1900	1,231	407,289
1894	3,246	228,246	1901	1,177	546,756
1895	3,222	238,060	1902	1,136	496,224

July 1, 1902, balance unexpended	\$12,334.41
Miscellaneous receipts	81.20

	12,415.61
June 30, 1903, amount expended during fiscal year	7,634.64

July 1, 1903, balance unexpended	4,780.97
July 1, 1903, outstanding liabilities	36.67

July 1, 1903, balance available	4,744.30
---------------------------------------	----------

July 1, 1903, amount covered by uncompleted contracts	550.84
---	--------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.	15,000.00	
		Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 3.)

4. *Harbor at Saugatuck, and Kalamazoo River, Mich.*—Before the work of improvement was begun by the United States, in 1869, this harbor, which is at the mouth of the Kalamazoo River, had been improved by local enterprise by the construction of slab piers 200 feet apart, the north pier being 500 feet long and the south pier 1,575 feet. The channel depth varied from 5 to 7 feet. The present project for the old harbor at the mouth of the river was adopted in 1867 and amended in 1869, 1875, and 1882. To June 30, 1903, \$186,745.93 had been expended, of which \$96,513.94 was for maintenance by dredging and pier repairs. At present there is a north pier 715 feet long, which

is entirely unserviceable; separated from the pier by a long stretch of unprotected bank there is a north revetment, partly destroyed and partly covered by sand. The south pier is 3,863 feet long and is practically ruined. Frequent dredging has been required for maintenance of an 8-foot channel, which rapidly deteriorates. Appropriations since 1882 have been too small to keep the piers in proper repair.

The existing project for the new harbor was adopted by the river and harbor act of June 3, 1896. It provides for creating a channel of 12 feet depth and navigable width by dredging the river for a distance of 1½ miles below Saugatuck, and thence making a new cut from the river to the lake, entering the latter about 3,700 feet above the present mouth at the Saugatuck piers. The original estimate for the work was \$150,000, but authority was granted on May 31, 1900, to increase this to \$250,000. To June 30, 1903, \$151.92 had been expended for contingencies.

The only work done during the past year was dredging for the purpose of opening an 8-foot channel at Saugatuck Harbor. As has been the case in the past, this channel deteriorates rapidly. The dredging that was done in September, 1902, was found obliterated last spring. Where the dredge had left 10 to 14 feet depths so much shoaling had occurred that only 6 to 8 feet depths were found, and the work of deepening the channel by dredging was again undertaken in June, 9,502 cubic yards of material having been removed in that month.

The project for opening a new channel from Kalamazoo River to Lake Michigan having been provided with additional funds in the sundry civil act of March 3, 1903, and there being \$114,907.11 available, specifications for the construction of two piers, forming part of the proposed improvement, were prepared, and bids were solicited for this work. The specifications provide that these operations may be carried on in 1904, at which time it is expected the work will be done.

It is proposed to complete the dredging operations now in progress, and to reserve a small balance of the funds available for maintenance for additional dredging.

Of the \$114,907.11 available for opening the new channel, about \$82,600 is required for pier construction, as per the lowest bid received, \$24,000 is to be allotted as part payment for the new hydraulic dredge, and the remainder will be reserved for contingencies.

The harbor is near a very prosperous fruit region and the fruit traffic has been its principal source of business. Saugatuck is but 8 miles south of Holland, with which it is now connected by a trolley road, and about 17 miles north of South Haven. Holland and South Haven both command other sources of business than the fruit traffic alone, and bid fair to increase in importance through the fact that they are termini of important railroad lines.

The Annual Report of the Chief of Engineers for 1896, pages 2741-2743, and House Document No. 192, Fifty-fourth Congress, first session, contain in full the report pertaining to the adopted project for the proposed change in the location of this harbor. The House document contains also a map of the locality.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1898.....	262	132,400	1896.....	848	153,190
1899.....	314	76,300	1897.....	586	70,360
1890.....	178	42,000	1898.....	1,329	128,325
1891.....	492	120,000	1899.....	1,190	88,236
1892.....	(a)	(a)	1900.....	1,859	120,946
1893.....	626	162,632	1901.....	(a)	(a)
1894.....	862	106,000	1902.....	808	101,756
1895.....	1,256	134,948			

(a) Not stated.

July 1, 1902, balance unexpended	\$29,941.51
Amount appropriated by sundry civil act approved March 3, 1903	100,000.00
	129,941.51
June 30, 1903, amount expended during fiscal year	4,900.36
July 1, 1903, balance unexpended	125,041.15
July 1, 1903, outstanding liabilities	96.66
July 1, 1903, balance available	124,944.49
July 1, 1903, amount covered by uncompleted contracts	5,000.00
{ Amount (estimated) required for completion of existing project	135,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	75,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 4.)

5. *Holland (Black Lake) Harbor, Michigan.*—When improvement was begun in August, 1867, by the United States, there existed a narrow channel 5½ feet deep between piers built of brush and of irregular cribs. These had been constructed by the harbor commissioners of the adjoining town of Holland.

The present project was adopted in 1867 and amended in 1873, 1879, 1884, and 1892. From 1867 to 1880 there were built by the United States piers and revetments aggregating 1,854 feet on the north side and 1,531 feet on the south side. Since the latter date there have been no additions to these structures, which were designed to create a 12-foot channel varying in width from 160 feet inside to 213 feet outside, except, in 1889, a length of 160 feet of pile pier on the south side, designed to close a gap in the existing structure. Upon this project there was expended up to March 3, 1899, \$304,217.30, of which \$127,597.50 was for maintenance. Repairs made during recent years have diminished the width inside to 148 feet.

The revised project at present in force was adopted in the river and harbor act of March 3, 1899, and provides for securing a channel 16 feet deep, protected by piers and revetments 148 feet to 250 feet apart, the estimated cost of completion being \$240,000. From March 3, 1899, the date of adoption of the present project, to June 30, 1903, there was expended \$48,781.83, of which \$14,324.73 was for maintenance by dredging.

Repeated dredging is necessary to secure temporarily the required depth at this harbor. Soundings made March 25–30, 1903, showed the

following available depths: 10.2 feet on the outer bar, deepening to 12.5 feet between the piers near shore line, and to 14 feet at the Black Lake end of the channel. Dredging commenced May 11 and completed June 17, 1903, improved these depths as follows: 17 feet at the outer end of the piers and 15 feet between the piers.

When the contract made May 18, 1903, for pier repairs is completed, not later than August 1, 1904, the existing structures will be in good condition, and will allow the dredged channel between the piers to be widened without danger of undermining them.

Of the funds available for this harbor, \$23,306 will be expended for work under existing contract for pier repairs, \$20,000 of the remainder has been allotted as part payment for a new hydraulic dredge, and \$1,000 for part payment of a new inspection steamer, the remainder to be reserved for additional dredging, incidental repairs, and contingencies.

The piers at this harbor have not been extended since 1880, and in the meantime the shore line on both sides has advanced and the lake bottom in the neighborhood of the entrance has shoaled so that the natural depth is but from 7 to 8 feet. The present approved project calls for a 16-foot channel, which is urgently needed by the navigation interests. To provide this channel the approved project provides for extending the north pier 800 feet and the south pier 700 feet. Even after these extensions are built periodical dredging will be required at an annual cost at first of from \$2,000 to \$3,000; and later, as the effect of the deteriorating influences increases, of from \$4,000 to \$5,000.

It is probable that extensive dredging operations, with a hydraulic dredge, as proposed, will reduce the amount of pier extension above estimated.

This harbor is relatively an important one, being the terminus of one of the lines of the Pere Marquette Railroad Company, which here connects with two lines of steamers, which, during the season of navigation, and when the condition of the harbor permits, run regularly to Chicago and Milwaukee. The passenger business is especially important, but there is also a profitable freight traffic, especially during the fruit season. The harbor justifies early improvement in accordance with the requirements of the revised project.

The report upon which the present revised project is based is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2950, 2951.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1889.....	1,087	80,790	1896.....	408	269,182
1890.....	(a)	(a)	1897.....	456	153,862
1891.....	2,676	178,300	1898.....	538	168,119
1892.....	2,800	200,000	1899.....	527	(a)
1893.....	2,060	315,150	1900.....	862	354,718
1894.....	1,816	159,657	1901.....	878	600,584
1895.....	809	210,299	1902.....	948	(a)

^a Not stated.

July 1, 1902, balance unexpended	\$76,352.86
Miscellaneous receipts	1,100.00
	77,452.86
June 30, 1903, amount expended during fiscal year	10,037.87
	June 30, 1903, balance unexpended
July 1, 1903, balance unexpended	67,414.99
July 1, 1903, outstanding liabilities	50.00
	July 1, 1903, balance available
July 1, 1903, balance available	67,364.99
	July 1, 1903, amount covered by uncompleted contracts
July 1, 1903, amount covered by uncompleted contracts	23,892.92
{ Amount (estimated) required for completion of existing project	129,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.	65,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 5.)

6. *Grand Haven Harbor, Michigan.*—This harbor is at the mouth of Grand River, the largest river in the State of Michigan. Before any work had been done the natural depth at the mouth of the river varied from 9 to 12 feet, with greater depths in the inner reaches.

In 1857 the Detroit and Milwaukee Railroad Company (Grand Trunk), whose western terminus is at the town of Grand Haven, built a pile pier 3,185 feet long upon the south side of the entrance, and also revetted, by means of close piles, portions of the bank upon the north side of the river. In 1866, when work by the United States was begun, the pile pier had been partly destroyed by fire and by storms. The available depth was 13 feet.

The present project was adopted in 1866, amended in 1868, 1880, 1890, and 1892. It provides for the construction of parallel piers and revetments 400 feet apart, with the object of creating an entrance channel 18 feet deep. Estimated cost was \$804,366.15. The amendments to the original project did not materially change its original purpose, the changes being principally in the proposed length of the piers and revetments.

To June 30, 1903, there had been expended upon the existing project the sum of \$766,065.98, of which \$223,089.16 was applied to maintenance, consisting chiefly in repairs to existing structures.

The result of the above expenditure was the construction and maintenance of 3,538 linear feet of north pier and 5,774 linear feet of south pier, with a channel of variable depth between them maintained by occasional dredging. At present the entrance is obstructed by a central shoal, whose crest is at a distance of from 500 to 800 feet beyond the entrance, upon which the minimum available depth is 17.5 feet. The channel to the north of the shoal affords a minimum available depth of 17.8 feet and that to the south 20.5 feet. Between the piers the minimum available depth is 16.5 feet, and farther inside the available depth is 20 feet and more. The central bar above referred to serves seriously to impair what would be otherwise an excellent harbor. Its periodical removal should be provided for.

Operations during the year were carried on both by hired labor and by contract. Dredging at "The Sag" and in the channel between Grand River and Spring Lake was done by the Government dredge, and the south revetment and two places in the south pier that were

injured by colliding vessels were repaired by hired labor. The north pier is undergoing repairs by contract.

This harbor has for years been one of considerable importance. It is the western terminus of the Detroit, Grand Haven and Milwaukee Branch of the Grand Trunk Railroad, in connection with which is run throughout the year a line of steamers to Milwaukee. In addition there are two lines with regular and frequent scheduled trips to Chicago. All three lines do a large passenger and a very considerable freight business, especially during the season of fair weather.

The latest map of this harbor is found in the Annual Report of the Chief of Engineers for 1890, page 2650.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	1,508	1,406,600	1896.....	883	727,209
1889.....	1,110	649,370	1897.....	1,151	1,018,806
1890.....	1,172	834,089	1898.....	934	874,312
1891.....	819	616,422	1899.....	1,250	1,090,325
1892.....	815	693,835	1900.....	1,151	1,132,881
1893.....	761	613,425	1901.....	759	706,627
1894.....	641	504,609	1902.....	3,176	903,010
1895.....	574	482,822			

July 1, 1902, balance unexpended	\$22,592.71
Miscellaneous receipts	5,570.75

	28,163.46
June 30, 1903, amount expended during fiscal year	9,286.37

July 1, 1903, balance unexpended	18,877.09
July 1, 1903, outstanding liabilities	246.00

July 1, 1903, balance available	18,631.09
---------------------------------------	-----------

July 1, 1903, amount covered by uncompleted contracts	5,408.79
---	----------

{ Amount (estimated) required for completion of existing project.	25,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 6.)

7. *Grand River, Michigan.*—Before any work of improvement was done upon this stream the depth in the crossings over some of the bars did not exceed 2 feet.

Between 1881 and 1886 the sum of \$50,000 was expended in securing, by dredging, narrow channels through these bars, with a depth of about 4 feet. No further work was done until 1896, but even then, at the expiration of over ten years, traces of the dredged cuts were still apparent.

The present project, upon which work was begun in May, 1897, was adopted by the river and harbor act of June 3, 1896, and is based upon a report upon examination and survey reprinted in Report of the Chief of Engineers for 1892, pages 2369 to 2395. The project contemplates dredging a channel a distance of 38 miles, from Grand Haven to Grand Rapids, with a depth of 10 feet and a width of 100 feet. The project also proposes the use of contraction works wherever necessary to increase the effect of the dredging or to render it more permanent.

The estimated cost was \$670,500, but the project may be said to have been modified by act of June 13, 1902, and the cost increased to not less than \$774,000. To June 30, 1903, the sum of \$157,550.94 had been expended upon the project in dredging 450,970 cubic yards of sand, clay, cobblestones, etc., in building 106,041 linear feet of training walls, and in the purchase and maintenance of plant.

The available depths at extreme low water over the shoalest crossings now vary from 2.8 to 5 feet, there being only 5 crossings with less than 5 feet, and from Bass River to Grand Haven no depth of less than 5 feet exists.

The project is naturally one of constant repair and maintenance. High water ordinarily occurs in the early spring and is from 12 to 18 feet above low water in the neighborhood of Grand Rapids. In the lower part of the river the difference between the high and low stages becomes less, and at the mouth is inconsiderable. The commerce involved is purely prospective and it is probable that but little benefit will be derived from the improvement until it is practically completed.

Under date of April 25, 1903, the House Committee on Rivers and Harbors called upon the Board of Engineers constituted by section 3 of the river and harbor act of 1902 for a report as to the advisability of continuing or modifying this project. Pending action by Congress on this report, no estimate for continuing the work is submitted.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1896.....	282	46,750	1900.....	264	59,928
1897.....	77	30,390	1901.....	178	84,506
1898.....	76	86,793	1902.....	318	97,268
1899.....	323	64,242			

July 1, 1902, balance unexpended\$153,034.01
 June 30, 1903, amount expended during fiscal year 35,584.95

July 1, 1903, balance unexpended 117,449.06
 July 1, 1903, outstanding liabilities 3,683.91

July 1, 1903, balance available..... 113,765.15

Amount (estimated) required for completion of existing project 499,000.00
 (See Appendix O O 7.)

8. *Muskegon Harbor, Michigan.*—This harbor is the outlet of Muskegon River, one of the largest in Michigan, which before emptying into Lake Michigan expands into Muskegon Lake. The channel between the lakes in 1867, before operations were begun by the United States, was 3,000 feet long and about 12 feet deep, except at the entrance, where the depth was 11 feet, and the channel fluctuating. By private enterprise the entrance had been protected by converging slab piers.

The present project was adopted in 1866, and amended in 1869, 1873, 1881, 1884, 1890, 1892, and 1902. In its final form it provides for a through channel 20 feet deep and 300 feet wide, protected by piers and revetments. Estimated cost of completion of revised project of 1902, \$380,000. The various changes in the original project did not modify it essentially. They refer merely to the depth of the channel and to the width, length, and direction of the piers.

To June 30, 1902, there was expended upon former modifications of

the project the sum of \$526,293.36, of which \$138,074.94 was for maintenance by repairs and dredging. As a result of the above expenditure, therefore, there have been constructed a north pier and revetment 2,780 feet long, and a south pier and revetment 2,090 feet long, protecting a channel whose width varies from 308 feet at the entrance to 167 feet inside, while the maximum depth which can be carried over the shoalest point in the channel is at mean low water 17 feet. To procure and maintain this depth dredging operations were in progress June 30, 1903. During the fiscal year 1903, there was expended under the project approved June 13, 1902, the sum of \$6,856.16 for maintenance by dredging and repairs.

Dredging operations completed July 14, 1902, left a channel of navigable width and 17 feet deep from Lake Michigan to Muskegon Lake. Shoaling that occurred during the fall and winter reduced these depths so that only 15.4 feet was found for a width of 60 feet near the south pier and 14.2 feet in mid-channel, at the shore line, and 16 feet in places thence to Muskegon Lake, when surveyed in May, 1903. Important work elsewhere prevented dredging operations being again undertaken until June 18, 1903; but between that date and the close of the fiscal year, 18,865 cubic yards was removed and the channel was being restored.

When the repairs in progress have been completed, the timber work of the south pier and the projecting portion of the north pier, with the exception of some breaks caused by colliding vessels, will be in fair condition. The interior portions of the north pier and the revetment are in need of repairs, and the adopted project provides for rebuilding them on a line 300 feet distant from and parallel to the south pier.

During the season of navigation three lines of steamers regularly use this harbor, which is a terminus of three important railroad lines. Their business is a substantial one, and with increased facilities should grow considerably. A general freight and passenger business is done, and in the summer months is largely augmented by the fruit and the resort traffic. Muskegon Lake itself is a magnificent harbor, 5 miles long and about $1\frac{1}{2}$ miles wide, with depths varying from 30 to 40 feet. If readily accessible this would be an excellent harbor of refuge.

The Annual Report of the Chief of Engineers for 1901, pages 3131-3134, and House Document No. 104, Fifty-sixth Congress, second session, contain in full a report upon a preliminary examination of this harbor, in which it is estimated that to secure a channel 300 feet wide and 20 feet deep will cost \$380,000. This project was adopted by the river and harbor act of June 13, 1902. A map showing the harbor and the outlines of the above project accompanies the executive document mentioned.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	2, 683		1896.....	961	562, 757
1889.....	4, 626	884, 869	1897.....	1, 244	725, 514
1890.....	3, 786	649, 540	1898.....	1, 503	1, 165, 802
1891.....	2, 886	704, 046	1899.....	1, 545	1, 234, 193
1892.....	4, 174	740, 021	1900.....	1, 366	904, 636
1893.....	2, 482	834, 049	1901.....	1, 681	1, 154, 924
1894.....	1, 423	793, 184	1902.....	1, 219	778, 785
1895.....	887	441, 289			

July 1, 1902, balance unexpended	\$78, 206. 64
June 30, 1903, amount expended during fiscal year.....	6, 856. 16
July 1, 1903, balance unexpended	71, 350. 48
July 1, 1903, outstanding liabilities	294. 67
July 1, 1903, balance available	71, 055. 81
July 1, 1903, amount covered by uncompleted contracts.....	56, 891. 65
{ Amount (estimated) required for completion of existing project.....	305, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	135, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 8.)

9. *Pentwater and White Lake harbors, Michigan.*—These harbors were formerly carried as separate works, but are now consolidated in consequence of a provision in the river and harbor act of June 13, 1902.

(a) *White Lake Harbor.*—When the present project was adopted the natural outlet of White Lake, about 3,550 feet north of the present entrance, afforded a channel 5 feet deep and 125 feet wide between slab piers built by local enterprise.

The approved project provided for the abandonment of the old outlet and the creation of a new one, 12 feet deep and 200 feet wide between piers and revetments. This project was adopted in 1866, amended in 1873, 1884, and 1892, the present amended estimated cost being \$353,550. The various amendments to the original project have not altered it materially, as they relate principally to the length of the proposed piers and revetments. The existing project, therefore, provides for the creation and maintenance of a channel 12 feet deep between piers and revetments about 184 feet apart.

To June 30, 1903, there was expended upon the existing project the sum of \$328,145.12, of which \$120,282.68 was for maintenance by dredging and repairs. This expenditure procured the construction and maintenance of a north pier and revetment 1,715 feet long, and a south pier and revetment 1,953 feet long, the natural depth of the channel between them being about 10 feet. Periodical dredging is necessary to secure and maintain a 12-foot channel. Up to June 30, 1903, the maximum draft that could be carried over the shoalest point of the channel was 12 feet.

Dredging operations for the temporary restoration of channel depths were completed October 4, 1902. A channel 60 feet wide and 15 feet deep resulted from these operations, the increased depth having been secured to allow for shoaling.

The repairs of the north pier and the refilling of the pile portions of the north and south piers were begun under contract of May 22, 1903, and are in progress at the close of the fiscal year.

The harbor is but 10.5 miles north of Muskegon. Such traffic as there is hardly exceeds in value the annual expenditure necessary to maintain a reliable 12-foot channel.

The last published map of the locality is contained in the Annual Report of the Chief of Engineers for 1884, page 1982.

(b) *Pentwater Harbor.*—Before work was begun at this harbor by

the United States there existed an irregular channel 4 feet deep and 75 feet wide between slab piers built by local enterprise.

The existing project, adopted in 1867 and amended in 1873, 1884, and 1892, provides for widening the old entrance to 150 feet and deepening it to 12 feet, the sides being protected by piers and revetments. Estimated cost was \$327,713.40. The amendments to the original project relate merely to the length of the proposed piers and revetments and in no wise enlarge its original scope. The present project, therefore, provides for a channel 12 feet deep and about 150 feet wide, protected by suitable piers and revetments.

To June 30, 1903, there was expended the sum of \$277,622.27, of which \$97,749.12 was for maintenance by repair and dredging. The result was a channel 140 to 153 feet wide, whose natural depth is from 9 to 10 feet, protected by a north pier and revetment 2,226 feet long, and a south pier and revetment 1,847 feet long. Periodical dredging is necessary to secure the projected depth of 12 feet. The maximum draft which, on June 30, 1903, could be carried over the shoalest point in the improved channel was at low water 12.6 feet.

Dredging operations for the temporary restoration of channel depths at Pentwater Harbor were commenced October 8 and completed October 30, 1902. A channel 120 feet wide and 15 feet deep at the entrance, and 60 feet wide and 14 feet deep between the piers, resulted from these operations, the increased depth having been secured to allow for shoaling. No other work was done during the fiscal year, but a contract has been made for repairing 890 feet of the inner portion of the north pier; operations are to be commenced not later than August 1, and to be completed by November 15, 1903.

This harbor has not during the past year been served by any regular lines and its commercial importance, never great, has for some years past steadily diminished. The excellent and very important harbor of Ludington is 12 miles north of Pentwater.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1980.

Entrances and clearances.

WHITE LAKE.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	1,408	147,142	1886.....	281	34,574
1889.....	732		1896.....	245	27,962
1890.....	579	62,276	1897.....	247	33,409
1891.....	405	47,135	1898.....	175	16,415
1892.....	392	58,950	1899.....	(a)	(a)
1893.....	260	1,052,026	1900.....	(a)	(a)
1894.....	195	18,115	1901.....	(a)	(a)

PENTWATER.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	300	45,000	1895.....	500	.....
1889.....	(b)	(b)	1896.....	(b)	(b)
1890.....	27	2,559	1897.....	(b)	(b)
1891.....	1,140	71,260	1898.....	1,208	108,258
1892.....	(b)	(b)	1899.....	(b)	(b)
1893.....	116		1900.....	(b)	31,721
1894.....	60		1901.....	180	(b)

^a No data could be obtained.

^b Not stated.

July 1, 1902, balance unexpended	\$36,034.06
June 30, 1903, amount expended during fiscal year	8,431.45
July 1, 1903, balance unexpended	27,602.61
July 1, 1903, outstanding liabilities	120.00
July 1, 1903, balance available	27,482.61
July 1, 1903, amount covered by uncompleted contracts	18,265.65
{ Amount (estimated) required for completion of existing project	47,893.40
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	21,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 9.)

10. *Ludington Harbor, Michigan.*—This harbor is the outlet of Pere Marquette River, which expands into Pere Marquette Lake before emptying into Lake Michigan. In 1867, before improvement was begun by the United States, the outlet from Pere Marquette Lake to Lake Michigan had a length of 830 feet, protected by divergent slab piers. The entering depth was 7 to 8 feet.

The present project was adopted in 1867 and modified in 1885, 1889, 1890, and 1899. In its final form as adopted by the river and harbor act of March 3, 1899, it provides for a through channel 183 to 285 feet wide and 18 feet deep, protected by the requisite piers and revetments. Estimated amount required to complete revised project was \$210,000. It can not be said that the modifications of the original project materially changed it in any regard. The development of the harbor has been progressive, the changes in the original project affecting only the length of the piers and their direction and the depth between them. It may therefore be said that the estimated cost of completion of the present project is really the sum of the above amount and that previously expended, or \$591,055.91 in all.

To June 30, 1903, the sum of \$418,914.37 was expended upon the original project and its subsequent modifications. Of the above sum \$99,588.74 was expended for maintenance by repairs and dredging, of which \$14,850.12 was expended upon the repair of 444 linear feet of the north pier and 303 linear feet of the south pier, this work being a portion of that included in the modified project of 1899. As a result of the above expenditure there now exists a reasonably reliable 18-foot channel, protected by piers and revetments. Occasional dredging is necessary to give the 18-foot channel sufficient width.

Dredging operations in October and November, 1902, resulted in restoring the channel to a depth of 19 feet for the full width between the piers at the entrance, and to a depth of 18 feet for a width of 120 feet inside.

A contract entered into November 8, 1902, providing for the extension of the piers and for the repair of piers and revetments, is to be completed by December 31, 1903. Operations under this contract were in progress at the close of the fiscal year.

With the completion of the work under contract there will remain an extension of 300 feet to the north pier and 200 feet to the south pier to carry out the provisions of the adopted project. It is expected, however, to await the results of the proposed extensive dredging operations with the hydraulic dredge before extending the piers and to devote

the funds remaining available to additional dredging now needed, to part payment for the hydraulic dredge and its running expense, and to the ordinary repairs to the piers and revetments as may be required.

This harbor is one terminus of the main line of the Pere Marquette Railroad Company, which operates lines of car ferries from this point to Manitowoc, Wis., and Milwaukee, Wis. A line of passenger and package freight steamers owned by the railroad company also makes regular sailings to Milwaukee. The business done by the car-ferry lines is of enormous and constantly increasing importance in its effect upon freight rates to and from the northwest. The volume of this business has steadily increased. It is desirable to give to the car-ferry service the same assurance of regularity of schedule as exists in the case of the ordinary railroad lines. At present difficulty is usually experienced in the fall and winter months, due to the narrowing of the channel by a shoal from the north. The car ferries are large and unwieldy and require ample sea room. A narrow channel is therefore impracticable, and to assure safety and regularity to the service dredging should be done as late in the fall as is possible with the type of dredge available. With a first-class seagoing hydraulic dredge available, there would be practically no time when dredging could not be done.

The Annual Report of the Chief of Engineers for 1897, pages 2951-2953, contains in full the existing approved project, adopted by the river and harbor act of March 3, 1899. This is based upon a report which, with a map, is published in House Document No. 273, Fifty-fourth Congress, second session.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	1,778	277,074	1896.....	1,996	952,469
1889.....	1,759	.....	1897.....	2,063	2,944,425
1890.....	2,270	461,997	1898.....	2,493	2,014,019
1891.....	2,420	610,057	1899.....	2,587	2,254,495
1892.....	1,969	538,568	1900.....	2,637	2,526,244
1893.....	979	211,438	1901.....	3,188	3,413,041
1894.....	1,466	426,599	1902.....	3,359	4,012,658
1895.....	1,556	594,124			

July 1, 1902, balance unexpended \$78,203.00
 Amount appropriated by sundry civil act approved March 3, 1903 165,000.00

June 30, 1903, amount expended during fiscal year 243,203.00
 8,683.27

July 1, 1903, balance unexpended 234,519.73
 July 1, 1903, outstanding liabilities 442.50

July 1, 1903, balance available 234,077.23

July 1, 1903, amount covered by uncompleted contracts..... 97,992.88

{ Amount that can be profitably expended in fiscal year ending June 30,
 1905, for maintenance of improvement, in addition to the balance
 available July 1, 1903..... 15,000.00
 Submitted in compliance with requirements of sundry civil act of June
 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 10.)

11. *Manistee Harbor, Michigan.*—In 1866, previous to the beginning of work by the United States, the entrance to this harbor was improved by slab piers 100 feet to 150 feet apart, built by local enterprise, a navigable depth of 7 to 8 feet being thereby maintained.

The present project was adopted in 1867 and amended in 1871, 1873, 1875, 1884, 1890, and 1892, and provides for a channel of navigable width with a depth of 15 feet, extending from Lake Michigan to Manistee Lake, protected by piers and revetments at the entrance. The various modifications of the original project merely extended its limits, changed the proposed length of the piers and the proposed depth from 12 feet to 15 feet. Operations have been progressive, and no work under any of the projects not essential to the project in its final form has been done.

To June 30, 1903, there had been expended \$392,595.81, of which \$87,367.60 was for maintenance by dredging and repairs.

As a result of the above total expenditure to June 30, 1902, there had been built 2,906 linear feet of north and 1,300 linear feet of south pier and revetment, the width between the piers varying between 150 feet inside and 190 feet at the outer end of the south pier, which is 400 feet shorter than the north pier. The work of extending the south pier 150 feet, under contract dated November 14, 1902, was in progress at the close of the fiscal year and is to be completed November 1, 1903. The piers and revetments will then be in fair condition, but the portion of the north revetment occupied by the Manistee and Northeastern Railroad Company, referred to in the Annual Report for 1899, page 2940, still remains without repairs.

The through channel had at various times been dredged so as to afford the projected depth of 15 feet. This channel, however, requires periodical dredging. The maximum draft which on June 30, 1903, could be carried through the improved channel was 14.1 feet. Soundings made April and May, 1903, showed a mid-channel depth of only 14.1 feet. Provision is made by contract for dredging operations this season to restore the usual channel depths.

No additional extension of the piers is at present recommended and the estimate is merely for necessary repairs and dredging, and is placed at \$15,000.

The commerce tributary to this harbor is derived principally from the salt and lumber industries. The harbor is also a regular port of call for one line of steamers plying from Chicago to points upon the east shore of Lake Michigan, and a single steamer makes stated trips from Manistee to Milwaukee. There are three railroads running into Manistee, being the Pere Marquette, the Manistee and Grand Rapids, and the Manistee and Northeastern.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1890, opposite page 2618.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	3,595	966,221	1896.....	2,355	643,045
1889.....	3,524	945,329	1897.....	2,371	666,000
1890.....	3,691	975,049	1898.....	1,856	528,752
1891.....	3,617	1,079,818	1899.....	2,313	698,682
1892.....	4,044	1,028,629	1900.....	2,049	625,630
1893.....	2,831	959,560	1901.....	2,276	671,219
1894.....	3,064	956,463	1902.....	2,194	667,952
1895.....	3,064	980,645			

July 1, 1902, balance unexpended	\$45,344.13
June 30, 1903, amount expended during fiscal year	939.94
July 1, 1903, balance unexpended	44,404.19
July 1, 1903, amount covered by uncompleted contracts.....	16,037.76
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix O O 11.)	

15,000.00

12. *Harbor of refuge at Portage Lake, Manistee County, Mich.*—In 1879, when work was begun by the United States, there was a channel 4 feet deep and 130 feet wide between slab piers built by local enterprise.

The approved project, adopted in 1879 and amended in 1881 and 1890, contemplates the construction of a harbor of refuge, with an entrance from Lake Michigan 356 feet wide and 18 feet deep, protected by piers and revetments. Estimated cost, revised in 1897 and 1899, was \$344,300.

The modifications of the original project have in no way changed its scope, so that essentially the project is to-day as when originally adopted. All expenditures made up to the present time have contributed to the completion of the project in its present form.

To June 30, 1903, there had been expended the sum of \$311,399.39, of which \$94,091.77 was for maintenance by repair and dredging. Of the above total expenditure, \$154,107.11 was expended upon the completion of 16 cribs, 7 in the north and 9 in the south pier, thereby extending these piers respectively 700 and 900 feet. The approved project is now completed, with the exception of the dredging necessary to provide the 18-foot channel, work on which is in progress.

Repairs to 787 feet of pile work of the south pier are to be made under contract entered into April 17, 1903, and will leave the works in good condition. Dredging is in progress under contract that will provide a channel of the projected depth 18 feet and 180 feet wide, but it is estimated that 100,000 cubic yards additional dredging between the piers will be required to reduce the high banks that will remain after the channel of 180 feet in width has been made.

On June 30, 1903, the maximum draft that could be carried from Lake Michigan to Portage Lake was 9.9 feet, which will be rapidly increased by the dredging operations now in progress.

Until the projected dredging has been completed, this harbor will not be available for the purpose for which it has been designed. There is absolutely no local commerce. When the harbor of refuge is completed, its existence will serve to permit vessels engaged in the general lake commerce, if necessary, to approach more closely the east shore of Lake Michigan, which in this vicinity has hitherto been destitute of harbors readily available in foul weather.

The last published map of this locality is found in the Annual Report of the Chief of Engineers for 1884, page 1974.

July 1, 1902, balance unexpended	\$59,464.96
June 30, 1903, amount expended during fiscal year	1,364.35
July 1, 1903, balance unexpended	58,100.61
July 1, 1903, outstanding liabilities	86.67
July 1, 1903, balance available	58,013.94
July 1, 1903, amount covered by uncompleted contracts	44,608.35
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 12.)

13. *Frankfort Harbor, Michigan.*—In 1867, when the United States began work of improvement at this harbor, which is the outlet to Lake Aux Becs Scies, there existed an outlet about 750 feet north of the present channel, affording a depth of 3 to 4 feet, and width of 70 to 80 feet between slab piers, built by local enterprise.

The present project was adopted in 1866, and as amended in 1868, 1879, and 1892, provided for a new outlet, with channel 12 feet deep and 200 feet wide, protected by piers and revetments. The estimated cost, revised in 1897 in compliance with the river and harbor act of June 3, 1896, to cover the cost of securing channel 18 feet deep, was \$413,659.85, further revised in 1899 to \$421,938.35. The changes in the original project have been in effect merely extensions, so that the existing project does not differ in kind from the original one. All expenditures may therefore justly be regarded as pertaining to the present project.

To June 30, 1903, there had been expended the sum of \$383,121.29, of which \$91,914.30 was for maintenance by repairs and dredging, \$6,592.88 of this latter sum having been expended in dredging and for contingencies. The total expenditure above mentioned has resulted in the creation and maintenance of a channel 18 feet deep, whose natural depth is 12 feet, the width being 200 feet. It is protected by a north pier and revetment 1,699 feet long, and a south pier and revetment 1,938 feet long, of which the outer 400 feet was built by the Toledo and Ann Arbor Railroad Company. Annual dredging is required to maintain the depth needed for navigation.

On June 30, 1903, the maximum draft that could be carried through the improved channel was 19.6 feet. There was 25,023 cubic yards dredged from the channel under contract between September 16 and October 9, 1902, which restored the entrance depth to 19 feet, and that between the piers to 18 feet.

Operations for the extension of the north pier 200 feet, and for the repairs of the south pier are in progress under contract dated April 17, 1903, with a fair prospect of completion on time, September 15, 1903.

Provision has been made, by contract, for additional dredging during the latter part of the season, in order that the required depth and width of channel may be maintained. The adopted project requires 100 feet additional extension to both piers, but it is proposed to await the results of the extensive dredging operations with the hydraulic dredge before extending them; consequently, the estimate for further operations is confined to incidental repairs and dredging, and is placed at \$20,000.

Practically the entire commerce of this harbor is transacted by the car-ferry lines of the Ann Arbor Railroad, which has its northern terminus at this harbor. These car ferries run to Kewaunee and Marinette, Wis., upon the west shore of Lake Michigan, and form a highly important link in the through commerce between the Northwest and the Atlantic seaboard. The importance of maintaining adequate facilities at Frankfort Harbor is manifest. This can be done with certainty only by repeated, radical dredging. Pier extension unaccompanied by thorough dredging will not serve.

The last published map of this harbor is found in the Annual Report of the Chief of Engineers for 1884, page 1973.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	1,342	216,376	1896.....	1,374	509,277
1889.....	(a)	(a)	1897.....	1,714	706,546
1890.....	443	57,140	1898.....	1,681	793,896
1891.....	1,541	258,908	1899.....	1,790	1,405,955
1892.....	910	167,777	1900.....	1,480	1,308,722
1893.....	988	278,709	1901.....	1,757	2,470,722
1894.....	1,101	337,728	1902.....	1,842	2,020,573
1895.....	1,182	412,951			

a Not stated.

July 1, 1902, balance unexpended \$55,909.94
 June 30, 1903, amount expended during fiscal year 6,592.88

July 1, 1903, balance unexpended 49,317.06
 July 1, 1903, outstanding liabilities 186.67

July 1, 1903, balance available 49,130.39

July 1, 1903, amount covered by uncompleted contracts 26,056.32

{ Amount that can be profitably expended in fiscal year ending June 30,
 1905, for maintenance of improvement, in addition to the balance
 available July 1, 1903..... 20,000.00
 Submitted in compliance with requirements of sundry civil act of June
 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 13.)

14. *Charlevoix Harbor and entrance to Pine Lake, Michigan.*—In 1868, when the first estimate for improvement was made, the available channel in Pine River, between Lake Michigan and Round Lake, was 75 feet wide and 2 to 6 feet deep. Up to 1873 the local authorities, with some assistance from the State, had constructed 468 feet of crib work in the north pier and 80 feet of crib work in the south pier, and the available depth was 6 feet. The first appropriation by the United States was made in 1876, and actual operations were begun in fiscal year 1878 upon the lower channel; the first appropriation for the upper channel was made in 1882, and actual work begun in 1885. Total estimated cost was \$186,000.

The original project was proposed in 1868 and, as amended in 1876 and 1882, provided for a 12-foot channel from Lake Michigan to Pine Lake between piers and revetments 100 to 150 feet apart, and from Round Lake to Pine Lake between revetments 83 feet apart. The following provision of the river and harbor act of June 13, 1902, may be said to have extended the scope of the original project: "Improv-

ing harbor at Charlevoix and entrance to Pine Lake, Michigan, continuing improvement, twenty thousand dollars, to be first expended in obtaining a uniform depth of channel from Lake Michigan to Pine Lake." The controlling depth of the lower channel in June, 1902, was 16.3 feet, and an emergency contract was made to dredge the upper channel to 17 feet. The material dredged amounted to 30,370 cubic yards and effected the desired deepening.

Soundings made June 11-15, 1903, showed an available depth of 15.8 feet at the pier heads, 16.2 feet between the piers of the lower channel, and 18 feet in the upper channel. Dredging is soon to be begun with a view to maintaining a depth of not less than 17 feet through both channels.

Needed repairs to the piers and revetments have been placed under contract, and the work is to be completed November 15, 1903.

The project for this harbor contemplates 200 feet extension of the piers, additional repairs of the piers and revetments, and dredging from time to time as required.

Up to June 30, 1903, the sum of \$162,062.44 had been expended upon the existing project and its various modifications. The result was a channel 15.8 feet deep, whose natural depth is 10 feet, protected in its two divisions by a north pier and revetment 2,064 feet long and a south pier and revetment 2,396 feet long. Of the above total expenditure \$81,857.40 was for maintenance by repair and dredging. The only work done during the past fiscal year was dredging under contract for the purpose of removing obstructing shoals, and the expenditure during the year, amounting to \$7,693.63, was for this work and contingencies. The above stated amount for maintenance includes all expenditures of any kind made since 1890, since which date no new work has been done.

The maximum draft which, on June 30, 1903, could be carried through the improved lower channel was 15.8 feet, and through the upper channel, 18 feet.

The principal traffic tributary to this harbor is furnished by the lumber industry, which has recently been growing greatly in importance. The principal sawmills are situated at Boyne and East Jordan, both at the upper end of Pine Lake, the outlet for which is the upper channel. Due to the fact that many of the lumber-carrying vessels do not clear at Charlevoix, the commercial statistics fail to disclose the full traffic, which is, however, known to be considerably over 1,000,000 tons. Charlevoix is also a much frequented summer resort and during the summer season two steamboat lines make regular and frequent calls at this harbor. There is in addition a small amount of local traffic. The 12-foot channel called for by the existing project is not sufficient for the needs of the lumber trade. The depth should be increased to 16 feet to enable the larger class of vessels to transact their business with economy.

The report upon a survey made with a view to obtaining a 16-foot channel is published in full in the Annual Report of the Chief of Engineers for 1897, pages 2953-2954, and is also printed with a map in House Document No. 144, Fifty-fourth Congress, second session.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1888.....	526	92,306	1896.....	420	75,268
1889.....	473	.....	1897.....	545	110,474
1890.....	532	75,224	1898.....	566	106,797
1891.....	534	79,613	1899.....	675	144,400
1892.....	537	79,966	1900.....	1,725	350,769
1893.....	820	144,976	1901.....	978	217,776
1894.....	1,701	333,015	1902.....	1,132	339,600
1895.....	528	92,387			

July 1, 1902, balance unexpended \$21, 131. 19
 June 30, 1903, amount expended during fiscal year 7, 693. 63

July 1, 1903, balance unexpended 13, 437. 56

July 1, 1903, amount covered by uncompleted contracts..... 10, 965. 02

{ Amount (estimated) required for completion of existing project 19, 800. 00
 { Amount that can be profitably expended in fiscal year ending June 30,
 { 1905, for works of improvement and for maintenance, in addition to
 { the balance unexpended July 1, 1903 39, 800. 00
 { Submitted in compliance with requirements of sundry civil act of June
 { 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix O O 14.)

15. *Petoskey Harbor, Michigan.*—Before work at this harbor was begun by the United States its landing pier was exposed to winds coming from between west and northwest, and in high gales it was dangerous to attempt a landing.

The present project was adopted in the river and harbor act of August 18, 1894. The approved project provides for constructing a breakwater 600 feet long about 600 feet west of the outer end of the landing pier, and another north of it 500 feet long, or as much longer as may be found necessary to cover the landing from all dangerous seas. Work was begun in 1896. Estimated cost was \$170,000.

To June 30, 1903, there had been expended upon this work \$55,535.33, of which \$2,378.68 was for maintenance. Four hundred feet of the west breakwater and 200 feet of the north breakwater have been built of timber cribs resting upon a stone foundation in deep water and upon natural bottom in shallow water. The remaining 200 feet of the west breakwater has been constructed of riprap stone and bowlders of suitable size. The river and harbor act of June 13, 1902, provided as follows: "Improving harbor at Petoskey, Mich., continuing improvement, and for maintenance, \$15,000, and the Secretary of War is hereby authorized to change or modify existing plans: *Provided*, That the total of expenditure shall not exceed the amount estimated to complete under the existing project." Investigation has shown that the north breakwater is too near the wharf and that the entrance is too narrow. A contract has therefore been authorized, after due advertisement, for the removal of the north breakwater and the extension of the west breakwater, under which operations are to be commenced not later than May 1, 1904, and to be completed November 1, 1904.

During the past fiscal year no work was done at this harbor. The amount expended was for advertising, job printing, and other contingencies.

The business of this harbor is principally due to the numerous summer resorts upon Little Traverse Bay. Four lines of large steamers use the harbor as a port of call, and there is also a large and prosperous local business.

Entrances and clearances.

Calendar year.	Number.	Tonnage.	Calendar year.	Number.	Tonnage.
1893.....	1,338	8,000	1898.....	4,704	76,000
1894.....	4,160	20,000	1899.....		
1895.....	4,360	28,000	1900.....		
1896.....	3,156	24,000	1901.....		
1897.....	4,362	91,600	1902.....	1,000	120,000

July 1, 1902, balance unexpended	\$32,636.77
June 30, 1903, amount expended during fiscal year	172.10

July 1, 1903, balance unexpended	32,464.67
July 1, 1903, outstanding liabilities	40.00

July 1, 1903, balance available	32,424.67
---------------------------------------	-----------

{ Amount (estimated) required for completion of existing project	82,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	33,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix O O 15.)

IMPROVEMENT OF RIVERS AND HARBORS ON THE EASTERN COAST OF MICHIGAN.

This district was in the charge of Maj. Lansing H. Beach, Corps of Engineers. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

I. Cheboygan Harbor, Michigan.—The present harbor is the result of improvements made at the mouth of Cheboygan River since 1871, when the available depth of water was only 6 feet. The project called for a channel 200 feet wide and 14 feet deep, to be secured largely by revetments and guiding walls, and the estimated cost of the whole work was \$395,335. The project was modified in 1880 to increase the navigable depth to 15 feet, this channel to be obtained by dredging, and in 1896 to make it 18 feet, and such depth now exists from deep water in the Straits of Mackinac to a point about 2,700 feet below the upper limits of the harbor. The river and harbor act approved June 13, 1902, again modified the project, which now includes the dredging of an 18-foot channel as far up as the bridge. The Report of the Chief of Engineers for 1896, page 2723, summarizes the history of operations to that date.

The work done since was in 1899 and 1900, when 106,115 cubic yards of sand, clay, and mill refuse was removed, at a cost of 14.7 cents per cubic yard, scow measure, and in 1903, when 27,304 cubic yards was dredged, at a cost of 24 cents per cubic yard, scow measure, and the channel carried forward according to project to within 1,300 feet of the upper limits of the harbor, which distance still remains to be dredged.

The total length of improved channel from deep water in the Straits

of Mackinac to the State Road Bridge is 7,900 feet; of this, 5,900 feet is in the Straits of Mackinac.

The total amount expended to June 30, 1903, was \$173,239.11.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1893.....	155,896	285,189	1898.....	366,332	334,636
1894.....	76,564	227,346	1899.....	152,689	352,214
1895.....	110,062	216,868	1900.....	44,237	59,536
1896.....	163,362	362,011	1901.....	161,771	252,727
1897.....	147,255	298,161	1902.....	177,231	262,563

July 1, 1902, balance unexpended	\$10,409.96
June 30, 1903, amount expended during fiscal year	7,649.07

July 1, 1903, balance unexpended	2,760.89
July 1, 1903, outstanding liabilities.....	289.39

July 1, 1903, balance available.....	2,471.50
--------------------------------------	----------

(Amount (estimated) required for completion of existing project	7,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	9,000.00

Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 1.)

2. *Alpena Harbor (Thunder Bay River), Michigan.*—The original depth at the entrance to Thunder Bay River, which forms the harbor of Alpena, was only 7 feet, but local enterprise had secured a narrow channel 12 feet deep through the bar before work was undertaken by the Government in 1877, when, under the appropriation of the preceding year, a channel 13 feet deep and 200 feet wide was secured in the bay. Shoaling having occurred, the channel was again dredged in 1883, this time to a depth of 14 feet. In 1889 the project was modified so as to propose a channel depth of 16 feet and the extension of the improvement up the river about a mile to the vicinity of the dam across the river at that point, with widths varying as follows: Two hundred feet at the 16-foot contour in Thunder Bay, thence tapering to 100 feet at the light-house crib, thence 100 feet to the Second street drawbridge, thence 75 feet to the Minor Lumber Company's wharf, thence 50 feet to the upstream limit of the channel improvement.

This project was completed in 1893, and under it a channel 2,250 feet long and 100 to 200 feet wide was secured in Thunder Bay, and a channel 4,300 feet in length provided in the river. The channel was redredged in 1899.

No work was necessary at this locality during the past year.

The total amount expended to June 30, 1903, was \$49,674.07.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1893.....	51,600	808,968	1898.....	60,300	236,075
1894.....	102,700	363,291	1899.....	27,888	197,725
1895.....	35,957	269,208	1900.....	51,653	263,702
1896.....	94,067	255,687	1901.....	62,131	169,442
1897.....	78,378	238,161	1902.....	60,213	193,201

July 1, 1902, balance unexpended \$2,325.93
 June 30, 1903, amount expended during fiscal year..... 500.00

July 1, 1903, balance unexpended 1,825.93

(See Appendix P P 2.)

3. *Saginaw, Flint, Shiawassee, and Bad rivers, Michigan.*—(a) *Saginaw River.*—Before improvement the navigable capacity of this stream was limited by the bar at its mouth, where a channel depth of only 8 feet was available, and by many shoal stretches in the river between there and the city of Saginaw, over which still less depth was to be found. Its improvement was commenced in 1867 by dredging a straight cut through the bar at the mouth to a depth of 13 feet. In subsequent years the scope of operations was gradually extended to various shoals higher up, but subject to no general project until 1882, when a comprehensive and connected scheme of improvement covering the river to the city of Saginaw was adopted. It called for a navigable channel 14 feet deep and 200 feet wide from Saginaw Bay to the upper limits of Bay City, about 8 miles above the point of beginning, and thence to the head of navigation, some 16 miles farther up, a channel of the same width but only 12 feet deep. The estimated cost of this project was \$446,000, which, added to the estimated cost of the several preceding projects (\$294,378), gives \$740,378 as the estimate of cost for the whole improvement. These estimates concerned the question of original cost only and took no note of maintenance, which, in a stream of this character, is a matter of great and constant expense, and in the absence of appropriations specifically applicable thereto must be an annual tax of no small magnitude on the successive appropriations for construction. The sum total of appropriations that will have to be made before the work can be completed must therefore largely exceed the original estimates for construction only.

The total expenditure to June 30, 1903, was \$775,685.22, and the result has been to obtain only a narrow through channel, which has little permanence, and almost constant dredging is needed to maintain it. This has been the case especially as respects the section of river from Bay City to Saginaw and in a somewhat less degree through the bar at the river's mouth in Saginaw Bay. In order to restore and maintain the channel as required in the interests of navigation, the work of dredging should be constant until a depth of 14 feet and a minimum width of 150 or 200 feet is obtained.

Dredging on the river was commenced June 8, 1903, and was still in progress at the close of the year, 27,845 cubic yards having been removed through two shoals in Bay County.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1893.....	651, 163	1, 069, 298	1898.....	1, 126, 891	364, 561
1894.....		1, 108, 307	1899.....	728, 629	311, 547
1895.....	391, 751	347, 146	1900.....	482, 253	402, 827
1896.....	471, 106	240, 496	1901.....	1, 250, 292	694, 741
1897.....	996, 980	354, 860	1902.....	1, 012, 620	106, 409

(b) *Flint, Shiawassee, and Bad rivers.*—The river and harbor act of June 13, 1902, provided that not to exceed \$12,500 might be expended, in the discretion of the Secretary of War, in dredging these streams up as far as St. Charles, in accordance with plan published in House Document No. 135, Fifty-fifth Congress, second session, and in the Annual Report of the Chief of Engineers for 1898, page 2600. The estimated cost of the work, as stated in that document, is \$20,000.

There were no operations during the past year.

July 1, 1902, balance unexpended..... \$65, 964. 87
 June 30, 1903, amount expended during fiscal year..... 3, 900. 09

July 1, 1903, balance unexpended..... 62, 064. 78
 July 1, 1903, outstanding liabilities..... 5, 042. 87

July 1, 1903, balance available..... 57, 021. 91

July 1, 1903, amount covered by uncompleted contracts..... 17, 467. 13

(Amount (estimated) required for completion of existing project..... " 7, 500. 00
 Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903..... 30, 000. 00
 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 3.)

4. *Sebewaing River, Michigan.*—The original channel from Saginaw Bay, to the mouth of Sebewaing River had an available depth of scant 4 feet. The first improvement was made in 1875, by which an entrance depth of 6 feet was provided through a narrow channel at a cost of \$8,000, and this depth was increased to 7 feet in 1880–81 at a further cost of \$7,000. The river and harbor act of June 3, 1896, appropriated \$5,000 for further operations, in accordance with a plan of improvement submitted in report of November 30, 1895 (printed as H. Doc. No. 71, 54th Cong., 1st sess., and also in the Annual Report of the Chief of Engineers for 1896, p. 7743), which provides for extending the channel to the 8-foot contour in Saginaw Bay, a distance of about 15,000 feet from the river's mouth, and increasing its width and depth to 100 feet and 8 feet, respectively. The estimated cost was \$37,000.

No work was done up to June 30, 1899, as sufficient funds were not supplied for commencing it until the appropriation contained in the river and harbor act of March, 3, 1899, became available. Contract was made in 1899 to do the work, which was to be finished by Sep-

*This sum is required for completion of existing project for Flint, Shiawassee, and Bad rivers, and has no reference to Saginaw River.

tember 30, 1900. Owing to the difficulties of the locality and to other causes, the contract is not yet finished, although it is hoped that it will be completed during the present season.

Dredging operations were in progress up to the close of the fiscal year 1903, a total of 179,341 cubic yards having been removed.

The total expenditure on the existing project to June 30, 1903, was \$29,046.19.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1896.....	48,700	123,274	1900.....	24,200	118,225
1897.....	50,481	139,987	1901.....	17,625	77,998
1898.....	14,820	151,085	1902.....	33,500	44,750
1899.....	13,088	127,460			

July 1, 1902, balance unexpended	\$20,414.54
June 30, 1903, amount expended during fiscal year	12,460.73

July 1, 1903, balance unexpended	7,953.81
July 1, 1903, outstanding liabilities	952.42

July 1, 1903, balance available	7,001.39
---------------------------------------	----------

July 1, 1903, amount covered by uncompleted contracts.....	7,001.39
--	----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	5,000.00

(See Appendix P P 4.)

5. *Harbor of refuge at Sandbeach, Lake Huron, Michigan.*—The local name of the town at this place is Harbor Beach. The site for this harbor, selected in 1872 after careful consideration, is on the west shore of Lake Huron, 60 miles north of its outlet into the St. Clair River, and the artificial harbor built there since then is the only safe refuge on that coast from the foot of the lake to Tawas Bay, 115 miles above. The work of construction was commenced in 1873 under a project providing for three sections of breakwater made of stone-filled cribwork, so located as to shelter a water area of some 650 acres, and for deepening this area by dredging where necessary. The estimated cost was \$1,442,500. The sheltering breakwaters, with a total length of 8,132 feet, were completed in 1885, at a cost of about \$975,000, and since that time expenditures have been applied to keeping them in repair, dredging, regulating and controlling the berthing of vessels entering the harbor for refuge, engineering supervision, and general office expenses.

The total expenditure to June 30, 1903, was \$1,240,465.14.

The expenditure for the past fiscal year was applied to making some temporary repairs to superstructure of the main breakwater and to general contingencies, including custody of the harbor, supervision, control of vessels, and office expenses.

The number of vessels that entered the harbor for refuge during the past fiscal year was 1,270, with a total tonnage of 858,029. The grand total of vessels that have found shelter there from 1877 to 1902,

inclusive, is 31,418, the tonnage of which aggregated 12,234 296. The vessels sheltered in 1877 averaged 289 tons each, and those during the year 1902, 662 tons.

During the present fiscal year it is proposed to commence rebuilding the superstructure of the main breakwater of permanent materials, the work for which was under advertisement at the close of the fiscal year.

To render the harbor adequate for the number and character of vessels now seeking it for refuge, it is believed that certain work is necessary beyond that already authorized by Congress. The work of replacing the timber superstructure of the piers with imperishable materials has already received legislative sanction, but funds for the entire work have not yet been supplied. As works additional to this the harbor area should be increased by dredging, an interior pier should be constructed with a view to reducing deposits within the harbor and affording a mooring place for vessels, and the entrance should be deepened and widened. A detailed estimate for this work is as follows:

Concrete superstructure, main, south, and north piers, and riprap protection main pier.....	\$846, 000
Dredging 492,000 cubic yards of shale, at 50 cents.....	246, 000
Widening and deepening entrance.....	75, 500
Interior pier, 2,300 feet long.....	115, 000
Contingencies and supervision.....	117, 500
Total	1, 400, 000

The balance available July 1, 1903, is \$272,865.55, so that the amount remaining to complete the work herein recommended is \$1,127,134.45.

For the present, at least, the further sum of \$10,000 annually will be required for maintenance, custody, etc.

July 1, 1902, balance unexpended	\$286, 037. 80
June 30, 1903, amount expended during fiscal year	12, 695. 11
July 1, 1903, balance unexpended	273, 342. 69
July 1, 1903, outstanding liabilities	477. 14
July 1, 1903, balance available	272, 865. 55

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903^a210, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 5.)

6. *Mouth of Black River, Rouge River, and Monroe Harbor, Michigan.*—(a) *Mouth of Black River.*—An extensive shoal and a bar formerly existed in the St. Clair River adjoining the mouth of the Black River. The bar lay close to the American side and obstructed approach to the Port Huron docks, while the shoal, forming a "middle ground" nearly 50 acres in extent, crowded the main channel in a sharp curve close to the Canadian shore. In 1871 a project was adopted for dredging the bar and middle ground to a uniform depth of 15 feet. Work was commenced in 1872 and completed in 1878. The whole area was redredged between 1889 and 1892 and again in 1897 to a depth of 16 feet.

^a Of this amount \$50,000 is for continuing-contract work authorized by the river and harbor act approved March 3, 1899.

The total expenditure to June 30, 1903, was \$93,879.88.

No work was in progress during the past fiscal year. The shoal will re-form gradually, and as vessels of moderate draft habitually pass over this area instead of through the main channel, followed by those of deep draft, the maintenance of the improvement is highly desirable. Funds now in hand are sufficient for this purpose for the coming year.

(b) *Rouge River*.—This stream originally had a channel depth of from 10 to 17 feet from its mouth to the point at which the Wabash Railroad bridge crosses it, a distance of about 3 miles. During the years 1888 to 1892, inclusive, this part was improved by the Government so as to provide a minimum depth of 16 feet in a central channel 240 feet wide for a distance of 800 feet above the mouth, and thence 100 feet wide to the Wabash bridge. The cost of this improvement, originally estimated, was \$31,690.39. The total expenditure to June 30, 1903, was \$47,078.69, the result obtained being a 16-foot channel, as called for by the approved project, and its maintenance since 1892 to such extent as was necessary to meet the requirements of local commerce, but a gradual shoaling had taken place in the meantime, such as to limit navigation to vessels drawing 13 feet or less. Congress, by joint resolution approved April 11, 1898, authorized an extension of the improvement up to the Maples road, a distance of about 1½ miles above the Wabash Railroad bridge, limiting the expenditure for that purpose to \$5,000.

The river was dredged in 1900, but the amount of money available was not sufficient to give the full channel width contemplated by the project for the entire distance. Between the Wabash Railroad bridge and Maples road the channel was dredged 50 feet wide. The Rouge is practically without current except in rainy weather and the channel will require constant dredging for maintenance.

Dredging operations on this river were commenced June 11, 1903, and were still in progress at the close of the fiscal year, a total of 20,417 cubic yards having been removed through bars which have formed.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel, Rouge River.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1888.....	73, 732		1898.....	117, 486	10, 250
1894.....	47, 106		1899.....	92, 631	763
1895.....	113, 066	1, 024	1900.....	119, 712	4, 600
1896.....	120, 590	2, 905	1901.....	105, 583	782
1897.....	115, 987	9, 386	1902.....	56, 701	10, 000

(c) *Monroe Harbor*.—The harbor of Monroe, Mich., is within the mouth of the Raisin River, at the western extremity of Lake Erie. In its natural condition the river flowed into the lake through several ponds and winding creeks. The depth of water at the deepest mouth of the river in its natural condition did not exceed 5 feet.

The project for the improvement of this harbor was adopted in 1834 and was practically completed in 1845. It had for its object to dredge a new and direct channel 100 feet wide and 10 feet deep from the lake across the marsh, a distance of 4,000 feet, to the portion of the river ordinarily used as a harbor. The sides of the canal were protected by

a revetment and the entrance to the lake was protected by piers extending outward to a depth of 10 feet in the lake.

Subsequently the city of Monroe further improved the river channel by cutting a canal 1,400 feet long across a bend of the river.

The total expenditure to June 30, 1903, was \$251,772.45.

An inspection made June 24, 1902, indicates that the depth in the lake has been generally maintained and there is no special indication of a fill to be found there. Within the jetties, while the depth has generally been maintained, the width of the channel is somewhat reduced. The piers are in need of repairs.

From its size and depth of channel this harbor can not accommodate the larger class of vessels used upon the lake, and its commerce is not large. It is mainly used by excursion boats bringing passengers during the summer months.

Dredging on the river at this harbor was commenced May 21, 1903, and the work was completed June 8, 1903. Four thousand six hundred and sixty-three cubic yards was excavated at a point just below the city docks.

July 1, 1902, balance unexpended	\$12,419.71
June 30, 1903, amount expended during fiscal year	1,945.46
July 1, 1903, balance unexpended	10,474.25
July 1, 1903, outstanding liabilities	2,725.21
July 1, 1903, balance available.....	7,749.04
July 1, 1903, amount covered by uncompleted contracts.....	1,774.79

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903 ^a 13,000.00
 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 6.)

7. *Black River at Port Huron, Michigan.*—The improvement of this stream was inaugurated by the river and harbor act of September 19, 1890, under a project which contemplated dredging it to a navigable depth of 16 feet from its mouth to the Grand Trunk Railway bridge, at an estimated cost of \$75,000, and the act of July 13, 1892, directed that the improvement be extended 1,400 feet farther upstream, to Washington avenue. Operations were commenced in 1891 and continued until the summer of 1893, when the required 16-foot channel had been dredged throughout the designated limits to a width varying between 160 feet near the mouth and 50 or 75 feet in the contracted river sections above. The total length of channel so dredged was 9,700 feet. Before improvement the minimum channel depth was between 8 and 10 feet for about 1 mile from the mouth of the river, but only 6 to 8 feet from there up to Washington avenue. The narrow upstream section and some shoal spots in the wider section below were redredged in 1897.

The total expenditure to June 30, 1903, was \$46,554.97.

Experience and observation show that the narrow dredged channels • in the upper limits of the improvement can have no considerable degree of permanence, although the canal to be cut by the city of Port Huron from Lake Huron to the Black River, in the upper part of the town, for

^a For Rouge River and Monroe Harbor.

the purpose of flushing the stream should, if it has any effect, retard the deterioration somewhat.

Dredging is necessary for maintaining this improvement.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1893.....	175,081	7,487	1898.....	151,606	16,595
1894.....	116,535	4,413	1899.....	130,675	37,368
1895.....	104,850	6,825	1900.....	105,931	181
1896.....	186,987	2,569	1901.....	120,018	100
1897.....	96,925	1,455	1902.....	123,677	2,600

July 1 1902, balance unexpended \$695. 03
 June 30, 1903, amount expended during fiscal year 250. 00

July 1, 1903, balance unexpended 445. 03

{ Amount (estimated) required for completion of existing project..... 28,000. 00
 { Amount that can be profitably expended in fiscal year ending June
 { 30, 1905, for works of improvement and for maintenance in addition
 { to the balance unexpended July 1, 1903 13,000. 00
 { Submitted in compliance with requirements of sundry civil act of June
 { 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 7.)

8. *Pine River, Michigan.*—The \$5,000 appropriated for this river in 1875 was applied in dredging a channel 12 feet deep for a distance of 4,000 feet from the mouth of the river. This channel gradually shoaled.

The present project, adopted in 1895, provided for a channel 100 feet wide and 14 feet deep for a distance of 2,500 feet from the mouth of the river, thence 75 feet wide and 12 feet deep to Belknap's brick-yard, a total distance of 5,800 feet. The estimated cost was \$10,560. This project was completed under two contracts, one in 1896, the other in 1899, all dredging being in Pine River.

The amount expended on this project to June 30, 1903, was \$9,224.59.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>
1898.....	100,606	1,150
1899.....	734,725	7,060
1900.....	370	5,173
1901.....	237	2,145
1902.....	767	4,842

July 1, 1902, balance unexpended \$1,335. 41
 July 1, 1903, balance unexpended 1,335. 41

(See Appendix P P 8.)

9. *Belle River, Michigan.*—The original project for this river, adopted in 1880, contemplated the formation of an ice harbor of refuge by dredging a channel 50 feet wide with depths of 13 feet and 12 feet. This work was completed between 1881 and 1885.

This channel having shoaled, the present project was adopted in 1895. It provides for a channel 75 feet wide, 15 feet deep from the St. Clair River to the Bridge Street Bridge, and 14 feet from that point to the Broadway Bridge, a total distance of 5,400 feet. The estimated cost was \$21,340. This work was accomplished in two contracts from 1896 to 1899, all dredging being in Belle River.

The principal use of the improvement is as an ice harbor of refuge.

No work was in progress during the past year. The whole amount expended on the project to June 30, 1903, was \$10,940.46.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1897.....	11,396	.....	1900.....	23,371	4,548
1898.....	10,044	3,550	1901.....	15,616	2,928
1899.....	5,573	878	1902.....	12,499	1,736

July 1, 1902, balance unexpended..... \$4,059.54

July 1, 1903, balance unexpended..... 4,059.54

(See Appendix P P 9.)

10. *Clinton River, Michigan.*—This stream empties into Anchor Bay, in the northwesterly part of Lake St. Clair, and before improvement had a channel depth of about 10 feet, except at several shoals, over which but 5 or 6 feet could be carried, and a broad flat at the mouth with a general depth of from 3 to 4 feet. In 1870–71 a channel 9 feet deep, 60 feet wide, and 2,700 feet long was dredged through this flat, but being left without works of protection, it soon filled up again. In 1885 a project of general improvement was adopted, which provided for a through channel 8 feet deep to Mount Clemens (8 miles upstream), for a pile dike extending across the flat at the mouth to the curve of 10 feet depth in the bay, and for revetments, as needed above. The estimated cost, as modified in 1889, was \$34,564.

The total expenditure to June 30, 1903, was \$68,321.93, of which \$25,500 was applied to occasional and scattering work done before the adoption of the general project of 1885, leaving \$42,821.93 as the amount applied to the latter.

The river and harbor act of June 13, 1902, authorizes the Secretary of War, in his discretion, to use any sum heretofore appropriated and now unexpended, in extending the channel up to the entrance of the Old Clinton and Kalamazoo Canal.

The character of the stream and engineering conditions are stated in the Annual Report of the Chief of Engineers for 1896, page 2736. It is not possible to make the improvement permanent without an expenditure disproportionate to the commerce of the river, and its maintenance can best be accomplished by periodical dredging, as has been done in the past.

No work was in progress during the past year.

COMMERCIAL STATISTICS.

Receipts and shipments by vessel.

Calendar year.	Received.	Shipped.	Calendar year.	Received.	Shipped.
	<i>Tons.</i>	<i>Tons.</i>		<i>Tons.</i>	<i>Tons.</i>
1896.....	30, 749	410	1900.....	32, 410	282
1897.....	29, 077		1901.....	36, 925	
1898.....	29, 085		1902.....	33, 868	
1899.....	35, 525				

July 1, 1902, balance unexpended \$6, 802. 41
 June 30, 1903, amount expended during fiscal year 60. 34

July 1, 1903, balance unexpended 6, 742. 07

July 1, 1903, amount covered by uncompleted contracts 3, 000. 00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903..... 3, 000. 00
 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix P P 10.)

IMPROVEMENT OF WATERS CONNECTING THE GREAT LAKES.

This district was in the charge of Maj. W. H. Bixby, Corps of Engineers. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. *Ship channel connecting waters of the Great Lakes between Chicago, Duluth, and Buffalo.*—Before the Government commenced the improvement of this water route the freight was largely carried by sailing vessels, and these and the few steamboats were limited in size to less than 350 feet length, 70 feet breadth, and 12 feet draft, this being the size of the Sault locks up to 1870. The total commerce in 1870 passing the Sault was less than 540,000 tons, or less than one sixty-fifth of that of 1902.

Prior to 1892 the improvement of this waterway was limited to individual places and local work, explained elsewhere under the heads of St. Marys River, Hay Lake, Lake St. Clair, St. Clair River, and Detroit River.

The present project was adopted by the river and harbor act of July 13, 1892, the object being to provide a navigable depth of 20 feet by excavating channels to a minimum width of 300 feet through the shoal places in the specified waters at an estimated cost of \$3,400,000, and work was commenced under approval of the War Department dated October 20, 1892.

The water surface has an oscillation varying from a few inches in many days during calms to about 2 feet per day in variable weather, and as much as 6 feet in Lake Superior and 8 feet in Lake Erie during hurricanes, and the monthly mean may change from 0.5 to 2 feet per year, or as much as 4 feet during forty years.

More extended information with sketches or maps may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792–1808, and 1895, pages 3052–3062 (special history Lake Superior to Huron);

1896, pages 2881-2889 (special history St. Clair River and Canal); 1891, pages 2794-2801 (special history Detroit River); 1895, page 2866 (map from Lake Superior to Lake Huron), and 1896, page 2758 (map from Lake Huron to Lake Erie).

Operations were commenced in the spring of 1893, and by 1897 channels of the required widths of 300 feet or more had been excavated through all the shoal areas that were considered when the project was adopted, and to 20 feet depth below the mean low-water surface as estimated at the time of the project, viz, 601.5 at Lake Superior, 584.2 at foot of Sault locks, 581.1 at Lake Huron, 575.5 at Lake St. Clair, and 572.6 at Lake Erie, these heights being measured above mean tide at New York. The maximum draft that could be carried over these shoals before improvement was from 15 to 16 feet at mean stage of water. Work since that time has been applied to increasing the width of channels at angles and other critical points and to removing numerous isolated shoals of comparatively small area that have been found in the through line of travel. In many instances there was no knowledge of the existence of the shoals, but in most cases they have been found in the course of surveys or examinations with a sweeping raft. The total expenditure on the improvement to June 30, 1903, was \$3,054,420.36.

The present commerce is about sixty-five times that of 1870, twenty-seven times that of 1880, and four times that of 1890.

During the past fiscal year there were removed from the St. Clair River section of the ship channel portions of two shoals at Port Huron, and Lake St. Clair at foot of canal, the total amount of material dredged being 143,566 cubic yards.

In the St. Marys River the bends of channel were widened at Sailors Encampment and Little Mud Lake, the total amount of material dredged being 129,675 cubic yards, and the gain in width at bends averaging over 100 feet. The result of the work was to provide a clear depth of 21 feet where the controlling depths before improvement ranged from 16½ to 18 feet. Work at present is being done to secure 21 feet at levels of 601.5 at Lake Superior, 580.4 at foot of Sault locks, 578.8 at Lake Huron, 575.1 (temporarily) at Lake St. Clair, and 570.8 at Lake Erie. Surveys and examinations with sweeping rafts during summer, and ice boring and sounding apparatus during winter, were continued over the remaining unsurveyed areas of St. Marys and St. Clair rivers. (For other like work along this route, see reports on Hay Lake and Detroit River.)

The unexpended balance of previous appropriations will suffice for all work required to complete improvements contemplated by the present approved project.

The amount of freight carried through the St. Marys River section of this channel during the navigable season of 1902 was 35,961,146 tons, valued at \$358,306,300. Approximate, but fairly reliable, statistics of traffic through the Detroit River indicate that about 44,000,000 tons of freight passed during that season.

July 1, 1902, balance unexpended	\$350, 719. 39
Received from sales	16. 70
	350, 736. 09
June 30, 1903, amount expended during fiscal year	^a 65, 156. 45
July 1, 1903, balance unexpended	285, 579. 64
July 1, 1903, outstanding liabilities.....	5, 497. 84
	280, 081. 80
July 1, 1903, balance available	
July 1, 1903, amount covered by uncompleted contracts.....	26, 792. 70
(See Appendix Q Q 1.)	

2. *St. Marys River at the falls, Michigan.*—Commercial navigation of the falls, or rapids, of this river at Sault Ste. Marie was impracticable until 1855, when the State of Michigan constructed a canal and double lock which provided a convenient navigable channel for vessels whose draft did not exceed 11.5 feet (12 feet in 1870) at mean stage of water. This improvement was completed in 1855, the double lock having chambers of 350 feet length and 70 feet width with gate openings 70 feet width arranged for 9 feet average lift at each lock, and the canal being about 5,400 feet long, with an available width of 70 feet and a top width of 100 feet. The commerce was in 1870 about 700,000 tons per year.

In 1870 the United States entered upon a project for increasing the canal to at least 100 feet width, building a new lock, and providing for 16 feet draft. The new lock (now known as the Weitzel lock) was opened to traffic in 1881, its single chamber being of 515 feet length and 80 feet width, with gate openings of 60 feet width, arranged for 18 feet average lift. The cost of the work from 1856 to 1885, inclusive, was \$2,875,692, including \$10,000 diverted from the 1864 Great Lakes appropriation. A rapidly increasing commerce developed as a result of these improvements.

The present project, presented in reports dated October 18 and December 22, 1886, which provided for building a new single-lift lock on the site of the old State locks, with a chamber of 800 feet length and 100 feet width and 21 feet of water over miter sills, and with gate openings of 100 feet width arranged for a lift of from 16 to 21 feet, the canal, together with its approaches, to be deepened to correspond, all at an estimated cost of \$4,738,865, was started by the river and harbor act of August 5, 1886, and adopted by that of August 11, 1888, and work was commenced under the approval of the War Department as given on October 28, 1886. The essential features of this project were so far completed in 1896 as to permit the new lock to be opened to navigation August 3 of that year, this lock being now known as the Poe lock. Work since that time has consisted in completing the deepening of the canal and its approaches, rebuilding and extending piers, grading and improving canal grounds, etc. The total expenditure to June 30, 1903, was \$4,026,796.25. Commerce is now about sixty-five times that of 1870 and four times that of 1890.

The water surface, usually changing slowly, may rise or fall as much as 6 feet during a severe storm, and the monthly mean may change as much as 2 feet in one year or 4 feet during forty years.

^a Includes \$3.28 paid by Treasury Department on account of Duluth, South Shore and Atlantic Railway Company.

The river and harbor act of June 13, 1902, authorized the diversion of \$20,000 of existing funds for special improvement of Sailors Encampment, Hay Lake; \$20,000 for salaries and expenses of a special Great Lakes and St. Lawrence River International Commission; a sufficient amount (probably about \$85,000) for the completion of certain new improvements of St. Clair Flats Canal, for which existing funds were insufficient, and extended the work at the falls so as to include widening and further improvement of the canal above the locks in the manner explained in House Document No. 128, Fifty-sixth Congress, second session.

The unfinished work of the 1886 project will require about \$525,000 and the widening, etc., of the 1900 project will require about \$1,050,000 (making a total of \$1,575,000), so that about \$964,000 more is needed for the work, to be contracted for in 1903 and 1904, the commencement of which has been authorized, but the completion of which has not yet been provided for by actual appropriations.

Reports as to the full cost of widening and further improvement as approved by the act of June 13, 1902, will be submitted to Congress at its next session.

More extended information may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792-1808 (special history); 1895, page 2866 (map); 1895, pages 3052-3062 (special history).

The commerce passing the falls during the navigation season of 1902, a period of 264 days, comprised 35,961,146 tons of freight, valued at \$358,306,300; the number of passengers reported during the same period was 59,337.

July 1, 1902, balance unexpended	\$766, 956. 31
Received from sales, etc	50. 25
June 30, 1903, amount expended during fiscal year	767, 006. 56
July 1, 1903, balance unexpended	737, 068. 75
July 1, 1903, outstanding liabilities and diversions under act of June 13, 1902	125, 736. 17
July 1, 1903, balance available	611, 332. 58
{ Amount (estimated) required for completion of existing project	963, 667. 42
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	964, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q Q 2.)

3. *Operating and care of St. Marys Falls Canal, Michigan.*—The former condition and results of improvement are the same as above stated for St. Marys River at the falls.

During the fiscal year ending June 30, 1903, the United States canal was open to navigation 250 days, the closed season being from December 17, 1902, to April 10, 1903, inclusive. A total of 16,615 vessels, aggregating 26,557,413 registered tons, and carrying 31,628,365 tons of freight and 21,966 passengers passed through the locks in 9,140 lockages. The Canadian canal at Sault Ste. Marie, Ontario, open 263 days, passed 4,851 vessels in 3,432 lockages, carrying 4,791,214 tons

^a Includes \$19.32 paid by Treasury Department on account of Michigan Central Railroad Company.

of freight and 34,419 passengers, making the combined traffic through the two canals 36,419,579 tons of freight and 56,385 passengers. This is an increase during the year of 10 per cent in tons, and decrease of 14 per cent in passengers.

The principal items of freight during the past fiscal year through both canals were: Iron ore, 23,910,461 tons; coal, 5,791,170 tons; flour, 8,527,331 barrels; wheat, 73,395,821 bushels; other grain, 31,711,628 bushels; lumber, 1,055,763,000 feet B. M.; and general merchandise, 714,540 tons.

Other statistics in relation to this traffic and commerce are summarized in the following statements:

Summary of traffic through St. Marys Falls Canal, Michigan, for the fiscal year ending June 30, 1903.

Number of vessels through Weitzel lock	6,009
Number of vessels through Poe lock	10,606
Number of lockages through Weitzel lock	3,934
Number of lockages through Poe lock	5,206
Total registered tonnage	26,557,413
Total freight tonnage	31,628,365
Total time spent in making lockages	hours.. 4,569
Average time spent in making a lockage	minutes.. 30
Total time spent by vessels in passing locks	hours.. 8,298
Average time spent by vessels in passing locks	29 minutes 58 seconds
Cost per lockage	\$9.17
Cost per passage	\$5.04
Cost per registered ton	mills.. 3.16
Cost per freight ton	do... 2.65

The Weitzel lock was open to navigation 220 days, from July 1 to December 2, 1902, and from April 27 to June 30, 1903.

The time for the Poe lock was 250 days, July 1 to December 16, 1902, and from April 11 to June 30, 1903.

Summary of St. Marys River commerce, via American and Canadian canals, during the calendar season of 1902, viz, from April 1, 1902, to December 20, 1902, a period of 264 days.

[All tons are net tons of 2,000 pounds.]

Total mile-tons	29,755,916,637
Total freight carried	tons.. 35,961,146
Total valuation placed on freight carried	\$358,306,300
Average value per ton of freight carried	\$9.96
Total amount paid for freight transportation	\$26,566,189.40
Average distance freight was carried	miles.. 827.4
Cost per mile per ton	mills.. .89
Average cost per ton for freight transportation	\$0.74
Total number of registered vessels using canals	935
Total number of passages by unregistered crafts carrying freight	490
Time American canal was operated	days.. 256
Time Canadian canal was operated	do... 264
Total valuation placed on registered vessels	\$70,997,400
Total number of passengers transported	59,377
Freight carried by—	
Registered vessels	tons.. 35,896,298
Unregistered vessels	do... 64,848
American vessels	per cent.. 96
Canadian vessels	do... 4
Passengers carried by—	
American vessels	do... 28
Canadian vessels	do... 72

This service is provided for from the permanent indefinite appropriation for operating and care of canals and other works of navigation under section 4 of the river and harbor act of July 5, 1884. The total expenditure on this account from 1881, when the Weitzel lock was first put in service, to June 30, 1903 (including \$7,040.42 outstanding liabilities), amounts to \$1,140,344.14, of which \$83,876.80 related to operations during the past fiscal year. The growth of freight traffic during the same period is shown by the following tabular statement:

Freight traffic of calendar years or navigation seasons.

	Tons.		Tons.
1881	1,567,741	1892	11,214,333
1882	2,029,521	1893	10,796,572
1883	2,267,105	1894	13,195,860
1884	2,874,557	1895	15,062,580
1885	3,256,628	1896	16,239,061
1886	4,527,759	1897	18,982,755
1887	5,494,649	1898	21,234,664
1888	6,411,423	1899	25,255,810
1889	7,516,022	1900	25,643,073
1890	9,041,213	1901	28,403,065
1891	8,888,759	1902	35,961,146

(See Appendix Q Q 3.)

4. Hay Lake and Neebish channels, St. Marys River, Michigan.—

The original conditions of this waterway are about the same as already explained for the ship channel and St. Marys River at the falls.

On account of rapids and shoals that intervened between the navigable channel of the river and the lake at its head and foot this channel was not navigable for commercial purposes before improvement.

The original project of improvement of 1882 contemplated the excavation of channels 17 feet deep and 300 feet wide through all obstructed portions of the Hay Lake route; but this project, modified in 1885 to provide a depth of 20 feet and to widen at angles and critical points, at a total estimated cost of \$2,659,115, was adopted by river and harbor act of August 5, 1886. The work of improvement was commenced in 1883, under War Department approval of October 27, 1882, and the route opened to commerce June 7, 1894, though full width and depth of channel had not then been obtained at all points; but since then several shoals in the deep-water section of the lake have been removed and the dredged channels have been widened at critical places.

The river and harbor act of June 13, 1902, appropriated \$500,000 and authorized work up to \$4,000,000 more for the completion of the Hay Lake and Middle Neebish channel project, and the commencement and prosecution of work upon a second channel of like dimensions from Hay Lake through the West Neebish to Mud Lake, so as to provide 21 feet minimum low-water depth over 300 feet minimum width of channel way from St. Marys Falls Canal to Lake Huron for descending boats, and an additional 300-foot width for ascending boats, the whole to be deepened where necessary to allow for recent low-water surfaces, from 1 to 3 feet lower than in past years. The sundry civil act of March 3, 1903, appropriated \$800,000 more for this same project. Reports as to the full cost of such work will be submitted to Congress at its next session.

The amount expended to June 30, 1903, was \$2,594,994.32 (excluding \$17,801.28 of outstanding liabilities), and the improvement as it stood at that date comprised 10 miles of channel dredged to a depth of 20 or 21 feet, in 5 miles of which the width was 300 feet and the remaining 5 from 450 to 1,100 feet. The new channel is 11 miles shorter than the old one via Lake George. It can be navigated with reasonable safety at night, which could not be done by the old route, and it is available for vessels drawing 5 feet more water than could be safely carried through the latter. The commerce is now about 36,000,000 tons per year.

The water surface, usually changing slowly, may rise or fall 2 feet during a severe storm, and the monthly mean may change as much as 2 feet in one year or 4 feet during forty years.

More extended information with sketches or maps may be found in Annual Reports of the Chief of Engineers for 1886, pages 1792-1808 (special history), 1895, page 2866 (map), and 1895, pages 3052-3062 (special history).

Operations during the past fiscal year were applied to widening the channel at Little Rapids so as to secure a full 600-foot width at this difficult locality, work being done under continuous contracts, and test dredgings were made at various parts of the channels to be deepened or opened. In all 2,104,814 cubic yards of material was removed during the year. Extensive surveys were made with reference to further improvements.

The whole commerce of the St. Marys River passes through this channel, except small river steamers engaged in local traffic and rafts of logs, which continue to be taken via the old channel as a measure of safety to general commerce. The following tabular statement indicates the extent and growth of this commerce from the year in which this route was opened for travel.

Season of navigation.	Freight.	Valuation.	Passengers.
	<i>Tons.</i>		
1894.....	13,195,860	\$143,114,502	27,296
1895.....	15,062,580	159,575,129	31,656
1896.....	16,239,061	195,146,842	37,086
1897.....	18,982,755	218,235,927	40,213
1898.....	21,234,664	233,069,739	43,426
1899.....	25,255,810	281,364,750	51,050
1900.....	25,643,073	267,041,959	58,565
1901.....	28,403,065	289,906,865	59,663
1902.....	35,961,146	358,306,300	59,377

Funds now available under old appropriations will be applied toward increasing the width of the Little Rapids division of this channel from its present minimum of 300 feet up to a uniform width of 600 feet, and the work will be done under continuing contracts as authorized by the river and harbor act of March 3, 1899, all the funds (\$494,115) having now actually been appropriated. These contracts are already in progress and will be completed in 1903. Under the funds and authority of the June 13, 1902, appropriation new contracts will be entered into upon the new completion of the old channel via the Middle Neebish and commencement of the new channel via the West Neebish, and \$500,000 will be needed under sundry civil act in 1904 for the next year's work.

July 1, 1902, balance unexpended	\$841, 660. 51
Amount appropriated by sundry civil act approved March 3, 1903	800, 000. 00
	1, 641, 660. 51
June 30, 1903, amount expended during fiscal year	^a 277, 539. 83
July 1, 1903, balance unexpended	1, 364, 120. 68
July 1, 1903, outstanding liabilities	19, 618. 51
July 1, 1903, balance available	1, 344, 502. 17
July 1, 1903, amount covered by uncompleted contracts.....	30, 574. 34
{ Amount (estimated) required for completion of existing project	3, 200, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q Q 4.)

5. *St. Clair Flats Canal, Michigan.*—Before the Government commenced work, in 1855, at this locality, boats were obliged to follow the natural delta outlet channels of the St. Clair River where the draft was less than 11 feet, in order to get from the river into the St. Clair Lake.

Between 1855 and 1865 the Government spent \$45,000 in gaining 1 or 2 feet depth temporarily through these delta channels.

The present improvement dates from 1866, and proposed a straight dredged cut across a flat where the depth was only about 6 feet, the object being to secure 13 feet depth over 300 feet width of channel, modified in 1872 to give 16 feet and in 1886 to give 18 and 20 feet, all at a total cost of \$1,326,060, as adopted by the river and harbor acts of June 23, 1866, and September 19, 1890, and approved by the War Department under various dates from 1866 up to October 9, 1890. This work was practically completed to 18 feet depth by 1892, after which it was incorporated into the 20–21 foot ship channel.

The dredged material was deposited so as to form dikes on each side of the cut, the channel faces of which are sustained by substantial sheet-pile revetments. In its present condition the width of waterway between revetments is 292 feet, depth of water 20 feet at mean stage in channel 260 feet wide, and length of each lateral dike 7,221 feet.

The water surface, usually changing slowly, may rise or fall 2 feet during a severe storm, and the monthly mean may change as much as 2 feet in one year or 4 feet during forty years.

The river and harbor act of June 13, 1902, appropriated \$330,000 and authorized the diversion from the St. Marys Falls appropriation of as much more as might be needed (now estimated at \$85,000) to commence and complete a second channel of 20 feet depth over 300 feet width alongside the existing channel, so as to provide two separate channels, one for ascending and one for descending boats.

The total amount appropriated for this improvement from its beginning in 1866 is \$1,094,810 (exclusive of the \$85,000 authority above referred to), and the total expenditure to June 30, 1903, is \$764,534.73.

The present commerce is greater than that of the St. Marys Falls Canal and less than that of Detroit River, being between the two, and is estimated at about 42,000,000 tons per year, being mostly through freights from Lake Erie to either Lake Superior or Lake Michigan.

^a Includes \$11.90 paid by Treasury Department on account of Michigan Central Railroad Company.

The work of the year has been that of surveys and other preparations for the new work of canal widening.

More extended information may be found in Annual Reports of the Chief of Engineers for 1896, pages 2881-2889 (special history), and 1896, page 2758 (map).

July 1, 1902, balance unexpended	\$332, 159. 39
June 30, 1903, amount expended during fiscal year.....	1, 884. 12

July 1, 1903, balance unexpended	\$330, 275. 27
--	----------------

(See Appendix Q Q 5.)

6. *Operating and care of St. Clair Flats Canal, Michigan.*—This service is provided for by the permanent indefinite appropriation for operating and care of canals and other works of navigation, under the provisions of section 4 of the river and harbor act of July 5, 1884.

Operations during the past fiscal year were of the same routine character as have been carried on since the canal was opened to traffic in 1871, viz, a custodian was present during the season of navigation to watch the passage of vessels, enforce regulations respecting traffic through the canal, and supervise all work required for the care and repair of the canal dikes. The expenditure on this account during the year up to June 30, 1903, was \$91,005.67 (excluding \$2,063.74 of estimated outstanding liabilities and contract obligations), of which \$5,975.85 was for the service of the preceding fiscal year.

(See Appendix Q Q 6.)

7. *Detroit River, Michigan.*—Before improvement the shoalest part of the channel through Detroit River was at the Limekiln Crossing, where the normal depth was 12½ to 15 feet over a bottom of solid rock.

The first projects of 1874 provided for a winding channel of at least 20 feet depth over 300 feet width, modified in 1883 so as to somewhat straighten such channel, in 1886 to give 400 feet width, in 1888 to give 440 feet width. The general depth above and below the Limekiln was 20 feet or more, but the bed of the river was studded with large boulders and rocky shoals, which limited the safe navigable depth to scant 15 feet through a distance of about 12 miles.

A new general project of improvement was thereupon adopted in 1892 for the removal of all obstructive shoals between the city of Detroit and Lake Erie, with a view to obtaining a through channel with a least width of 600 feet and navigable depth of 20 feet, at a total estimated cost of \$1,554,500, as adopted by river and harbor acts of July 13, 1892, and March 3, 1899, and as approved by the War Department at various dates from 1892 up to July 3, 1899. All of this amount has now been actually appropriated.

The water surface, usually changing slowly, may rise or fall from a few inches during many days of calm weather up to about 4 feet during severe storms, and about 6 feet during short severe hurricanes; and the monthly mean may change as much as 2 feet in one year or 4 feet in forty years.

The river and harbor act of June 13, 1902, appropriated \$500,000 and authorized work up to \$1,250,000 more for the commencement and prosecution of a new project (that of 1900), so as to provide 21 feet minimum low-water depth over 600 feet minimum width of channel

^a This does not include, however, the \$85,000 (estimated) to be diverted from the appropriation for improving St. Marys River at the falls under act of June 13, 1902.

from Detroit through Detroit River to Lake Erie. Four hundred and fifty thousand dollars more was appropriated by the sundry civil act of March 3, 1903. Reports as to the full cost of such work will be submitted to Congress at its next session.

The total expenditure on the improvement up to June 30, 1903, was \$1,513,782.80. As a result of the work done to that date, a channel ranging from 250 to 800 feet in width was obtained, in which the least depth at mean stage of water was 19 feet, and from 19 to 21 feet through most of the distance.

For the head of the river at Grossepoint a preliminary examination was favorably reported December 26, 1888, followed by survey reports of February 8, 1890 (printed together as H. Ex. Doc. No. 200, 51st Cong., 1st sess.; also Annual Report of the Chief of Engineers for 1890, pp. 2749-2752), with estimates of \$553,300 for 19.5 feet depth over 800 feet width, and \$690,800 for 20 feet depth.

No appropriation has yet been made for this work.

The commerce is estimated at 44,000,000 tons for the calendar year of 1902, being mainly through freight from Lake Erie to lakes Superior and Michigan, or from those places to Detroit, being more than twice that of 1892.

More extended information may be found as follows: Annual Reports of the Chief of Engineers for 1891, pages 2794-2801 (special history), and 1896, page 2758 (map).

Operations were in progress during the past fiscal year under six continuing contracts, and work by hired labor with Government plant, the result of which was to increase the minimum depth of the improved channel to 18.4 feet below present mean low water at the worst places and to 21 feet wherever work is being done. Extensive surveys relating to work in progress and projects for more extensive improvements now being started under recent appropriations were also made; the new work to secure at least 21 feet depth over at least 600 feet width along the entire route at the lowest monthly mean stage of the navigation season so far known.

The contracts already in progress under old appropriations will probably be completed in 1903. The new work under the authority and funds of the June 13, 1902, act will be started this fall under new contracts, and \$450,000 will be needed under sundry civil act in 1904 for the next year's work.

July 1, 1902, balance unexpended.....	\$788, 484. 65
Received from sales	91. 90
Amount appropriated by sundry civil act approved March 3, 1903.....	450, 000. 00
June 30, 1903, amount expended during fiscal year	1, 238, 576. 55
	247, 859. 35
July 1, 1903, balance unexpended	990, 717. 20
July 1, 1903, outstanding liabilities.....	48, 708. 43
July 1, 1903, balance available	942, 008. 77
July 1, 1903, amount covered by uncompleted contracts.....	5, 122. 10
{ Amount (estimated) required for completion of existing project	800, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	450, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Q Q 7.)

8. *Removing sunken vessels or craft obstructing or endangering navigation.*—Work of removal of the barge *Richard Winslow* from the shoals in the Straits of Mackinac, and of the schooners, *George H. Wand* and *Glenifer*, from the St. Clair River, was completed during the year. The total amount expended in the past year upon the removal of wrecks was \$4,708.06.

(See Appendix Q Q 8.)

SURVEYS REQUIRED BY THE RIVER AND HARBOR ACT OF MARCH 3, 1899.

The local officer was also charged with the duty of making surveys of *Detroit River from Detroit to Lake Erie* and of *waters connecting lakes Superior and Huron, including Hay Lake channel, St. Marys River, Michigan*. Preliminary reports have been transmitted to Congress and printed in Annual Report of the Chief of Engineers for 1900, page 4015, and for 1901, page 3200, respectively. It is expected that final reports will be submitted in time for transmission to Congress at its next session.

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS ON LAKE ERIE, IN THE STATE OF OHIO.

This district was in the charge of Maj. Dan C. Kingman, Corps of Engineers. Division Engineer, Col. O. H. Ernst, Corps of Engineers.

1. *Toledo Harbor, Ohio.*—The harbor of Toledo is in the Maumee River. The wharf frontage on the river extends over a distance of about 3 miles, the lower end of which is about 4 miles above the mouth of the river, at the head of Maumee Bay.

Originally the channels in the river were much better than in the bay, having minimum depths of 14 to 16 feet, while in the bay the least depths were 8.5 feet, and the maximum depth for most of the distance was but 12 feet.

In 1866 a project was adopted to dredge the channels of deepest water in the bay to a depth of 12 feet. The project was amended from time to time until 1887, when the old indirect channel had a minimum depth of 15 feet.

In 1887 a project was adopted for a straight channel through Maumee Bay, with a depth of 17 feet and a bottom width of 200 feet. The estimate of cost, including dikes or other channel protections, was \$1,875,000.

The project for a straight channel was amended in 1893 by increasing the width of outer section, about 3 miles long, to 300 feet. Since 1892 the improvement has been extended to include the Maumee River.

The present project was adopted in 1899 and was authorized by the act of Congress of that year. It is simply an enlargement of previous projects and provides for a channel in the river and bay 400 feet in width and 21 feet deep. A continuous contract was authorized for the execution of this work.

The total expenditure for improving and maintaining channels in Maumee River and Bay to June 30, 1903, was \$2,020,842.91.

All of this money was expended for the purpose of securing artificially deepened channels, and much of the work was temporary in character and amounted simply to maintenance. The net result on

June 30, 1903, was a channel 21 feet deep and not less than 200 feet wide from the upper limit of the harbor to the lake. Some portions of the channel had been widened to 400 feet, and work was in progress for the completion of the project.

During the past year the contractor dredged 983,893 cubic yards of material, and the United States dredge working in the river, when not employed elsewhere, dredged 182,270 cubic yards. In all 1,166,163 cubic yards of material was removed during the year. This amounts, with the work previously done, to nearly 5,000,000 cubic yards.

A recent examination of the channel shows a tendency to fill. The deposit is not uniformly distributed and in some places a slight scour is indicated. The results are such as to indicate the necessity of a large amount of annual dredging to maintain the improvement after it is once secured.

The river and harbor act of June 13, 1902, authorized the purchase of a hydraulic dredge, and the payment of the sum of \$40,000 toward it to be taken from the money appropriated for the improvement of this harbor. This machine will be very useful in maintaining the improvement. Bids for this dredge have been invited. For further details see Appendix I 6, herewith.

The commerce of Toledo for the calendar year 1902 amounted to 3,866,772 tons, an increase of 780,480 tons over that of the previous year. This is the first year in which the deep channel was available, and the results indicate that it is being taken advantage of.

July 1, 1902, balance unexpended.....	\$243, 723. 96
Amount appropriated by sundry civil act approved March 3, 1903.....	190, 000. 00
November 29, 1902, proceeds of sale of Government property.....	129. 75
June 30, 1903, amount expended during fiscal year.....	433, 853. 71
July 1, 1903, balance unexpended.....	319, 986. 84
July 1, 1903, outstanding liabilities.....	^b 11, 351. 52
July 1, 1903, balance available.....	308, 635. 32
July 1, 1903, amount covered by uncompleted contracts.....	594, 575. 97
{ Amount (estimated) required for completion of existing project.....	246, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903:	
For works of improvement.....	\$246, 000. 00
For maintenance of improvement.....	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	266, 000. 00

(See Appendix R R 1.)

2. *Port Clinton Harbor, Ohio.*—The harbor of Port Clinton is within the mouth of Portage River. This river flows into Lake Erie at a point about 13 miles by land and 22 miles by lake west of the city of Sandusky. In its natural condition the depth of water on the bar at the mouth of the river rarely exceeded 5 feet.

The project for its improvement was adopted in 1871 and slightly modified in 1872 and 1873. It provided for the construction of two parallel jetties extending outward from the mouth of the river to a depth of 10 feet of water in the lake.

^a Includes \$412.72 on account of construction of dredge.

^b Includes \$96.32 on account of construction of dredge.

The work done consisted mainly of sheet piling of oak plank, secured and reinforced by oak piles, with heavy oak waling pieces. The pier-head of the east jetty was a solid construction of piles and stone, and 720 linear feet of west jetty consisted of a substructure of piles with superstructure of timber cribwork, both filled with stone.

The jetties were extended to a depth of 10 feet in the lake in 1883. Since then no further extension has been made. The channel was dredged to a depth of 10 feet and a width of 100 feet between the jetties and a width of 200 feet inside the shore line in 1893 and 1894. The current in the river has been sufficient to maintain fairly well the depth thus artificially secured. The jetties, having become very much decayed, have been partially protected by stone piled against them on both sides, giving a slope of about 1 on 1. This stone is in turn protected by a covering of large stone which above water is roughly laid as a pavement.

The total amount expended to June 30, 1903, was \$98,917.38.

Though a depth a little greater than 10 feet had been secured by dredging through the jettied channel and outward into the lake, the full depth was not available for commerce on account of the slight fill outside of the jetties and also because a vessel requires greater depth of water in a seaway than in a sheltered channel. The funds available at the beginning of the fiscal year, amounting to \$5,653.53, were accordingly applied to deepening the channel to a depth of 12½ feet for a width of 150 feet from the outer end of the jetties outward to a corresponding depth to the lake. This leaves the harbor in a better condition than ever before and permits the full extent of the improvement to be made use of.

The present project now only provides for completely protecting the old wooden jetties by riprap; 13,296 tons of stone has already been used for this purpose, but further protection is necessary, particularly to the east jetty, the greater part of which was constructed of a single row of sheet piling. It is rapidly decaying and possesses now very little strength. The riprap protection comes barely to the surface of the water and should be carried a few feet higher to protect the channel when the sheet piling finally gives way. Five thousand dollars could advantageously be applied to continuing this work of riprap protection.

The commerce of Port Clinton is not large. The total amount reported for the calendar year 1902 was 11,613 tons. This is an increase of nearly 2,000 tons over that of the previous year, and the improvement made by dredging was not completed until too late in the season to be of much advantage.

July 1, 1902, balance unexpended	\$5, 653. 53
June 30, 1903, amount expended during fiscal year	5, 570. 91
July 1, 1903, balance unexpended	82. 62
July 1, 1903, outstanding liabilities	6. 71
July 1, 1903, balance available	75. 91

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	2, 500. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R R 2.)

3. *Sandusky Harbor, Ohio.*—The harbor of Sandusky is in the lower part of Sandusky Bay, along the city front, the part nearest to the lake being about 2 miles from the bar which divides the waters of the bay from those of the lake. In its natural condition the depth was only such as the bay afforded, which was about 10 feet along the city front and from 9 to 12 feet thence to the lake.

A long, flat sand bar divided the bay from the lake, this bar being cut through by a channel, from 1,000 to 2,000 feet in width, near its central portion. The southern part of the bar is called "Cedar Point" and the northern "Sand Point." Between these two points the currents between the bay and the lake, resulting from the action of the wind and from varying barometric pressures, had scoured out the channel to a depth of not less than 18 feet for a distance of a mile or more, the maximum depth being as great as 40 feet. This place has always been known as the "Deep Hole."

The first appropriation was made for a survey in 1826 and the first improvement was made in 1844, consisting in the construction of a dam to close a breach across Sand Point. With this exception all the improvements made previous to 1896 consisted in deepening natural channels and in making a new straight channel from the city front to Cedar Point and in removing sand and boulders from the dock channel along the city front. Natural causes have washed away a greater part of Sand Point since 1826, and there is now a space of about 7,000 feet between the edge of the Deep Hole and Sand Point in which the water has a depth of from 2 to 6 feet.

In 1896 and subsequently the project was added to so as to provide for the construction of a stone jetty upon a mattress foundation extending from Cedar Point outward, with a view to confining and directing the flow of water to and from the bay. Additional provision was also made for a spur upon the other side of the Deep Hole and a short piece of jetty, and for the protection by a mattress covering of a portion of the bank of the channel and the point of the bar near the light-house.

The present project, which was authorized by the river and harbor act of June 13, 1902, includes all of the permanent works of protection and regulation provided for in the earlier plans, at an estimated cost of \$274,564, and in addition provides for securing and maintaining a channel 21 feet deep at mean lake level, with a width of 400 feet in the approaches to the harbor front and 300 feet in the harbor channel, at an estimated cost of \$781,000. The estimated cost of completing the project, exclusive of the amounts heretofore appropriated, is \$930,000.

The total expenditure for improving Sandusky Harbor, from 1844 to June 30, 1903, was \$560,242.52.

This expenditure has resulted in the dredging as above described, and in the construction of a portion of the sill, jetties, dikes, and mattress which the plan provided for. In all, about 12½ per cent of the latter class of work has been accomplished.

The river and harbor act of June 13, 1902, appropriated \$125,000 for improving the harbor in accordance with the new project. It authorized \$40,000 of this sum to be applied toward the purchase of a hydraulic dredge. The remainder of the appropriation is to be applied to dredging by contract.

Proposals for the work were invited and were opened on August 14, 1902. The amounts were all deemed excessive, were rejected, and the work was readvertised. The second proposals were received and opened on September 5, 1902. Contract was entered into with the lowest bidder, and approved October 18, 1902.

Up to the close of the fiscal year only about 60,000 cubic yards of material had been excavated.

The receipts and shipments at the harbor of Sandusky for the calendar year 1902 amounted to 1,357,316 tons, an increase of nearly 170,000 tons over the business of the previous year.

July 1, 1902, balance unexpended	\$125,364.58
June 30, 1903, amount expended during fiscal year.....	3,815.10
July 1, 1903, balance unexpended	121,549.48
July 1, 1903, outstanding liabilities.....	8,273.00
July 1, 1903, balance available	113,276.48
July 1, 1903, amount covered by uncompleted contracts.....	66,020.32
(Amount (estimated) required for completion of existing project.....	930,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	143,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix R R 3.)	

4. *Huron Harbor, Ohio.*—This harbor is situated at the mouth of Huron River. In its natural condition the entrance was practically closed by a sand bar.

The first project for its improvement was adopted in 1826, and provided for the construction of two parallel jetties 140 feet apart extending outward from the river banks. These jetties were lengthened from time to time and repaired as required, and the channel was finally deepened by dredging.

In 1890 the project was modified to provide for the extension of the jetties to 16 feet of water in the lake, and for obtaining a like depth between them by dredging.

The total amount expended under all projects for all purposes of construction and maintenance to June 30, 1903, was \$222,227.18.

The present project for the improvement of this harbor is far from satisfactory. The width between the jetties, 140 feet, is not sufficient to afford a safe entrance for large vessels, and the depth, 16 feet, is not sufficient to meet the present requirements of commerce. In point of fact, the Wheeling and Lake Erie Railroad Company, under authority of the Secretary of War, has excavated and maintained for a number of years a narrow channel 20 feet deep between the jetties and outward to a corresponding depth in the lake.

Report of the survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Available funds are being applied to rebuilding a portion of the west jetty near the shore line. The details of the work are given in Appendix R R 4, herewith.

The receipts and shipments of this harbor for the calendar year 1902

amounted to 795,382 tons, an increase of more than 120,000 tons over the business of the previous year.

July 1, 1902, balance unexpended	\$43,279.81
June 30, 1903, amount expended during fiscal year	28,233.28
July 1, 1903, balance unexpended	15,046.53
July 1, 1903, outstanding liabilities	1,450.00
July 1, 1903, balance available	13,596.53
{ Amount (estimated) required for completion of existing project	77,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	60,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix R R 4.)	

5. *Vermilion Harbor, Ohio.*—Vermilion Harbor is at the mouth of Vermilion River, which empties into Lake Erie about 20 miles eastward from Sandusky.

The improvement of this harbor was first undertaken in 1836, when an appropriation of \$10,000 was made for this purpose. The original project provided for parallel jetties extending outward to 12 feet of water in the lake. The jetties were built, but the current only sufficed to maintain a channel of about 7 feet in depth across the bar. In the natural condition of the harbor there was only about 2 feet of water at this place. Dredging was accordingly resorted to and the project enlarged to provide for a depth of 14 feet of water. This involved the removal of rock and the project was never fully executed.

The total amount of money expended at this harbor for improvement and maintenance up to June 30, 1903, was \$133,277.55.

The last regular appropriation for the improvement of this harbor was made in 1896, and the total amount which has been available for it for the past twenty years has been less than \$10,000. As a result the superstructure of the piers is badly decayed and the channel has greatly deteriorated.

During the summer of 1902 the waves during a severe easterly storm cut a channel around the shore end of the east jetty and threatened to destroy the channel. An allotment of \$400 was made from the appropriation for emergencies in river and harbor works, act of June 6, 1900, and was applied to the closing of this breach.

The river and harbor act of June 13, 1902, requires an examination or survey of this harbor to be made. Report will be submitted to Congress at the coming session.

Amount allotted August 5, 1902, from appropriation for emergencies in river and harbor works, act of June 6, 1900	\$400.00
June 30, 1903, amount expended during fiscal year	400.00

(See Appendix R R 5.)

6. *Black River (Lorain) Harbor, Ohio.*—This harbor is within the mouth of Black River where it enters into Lake Erie 26 miles west of Cleveland. In its natural condition the depth of water at the mouth of this river did not exceed 3 feet, but the river itself was navigable for a distance of 3 miles from its mouth for all vessels then in use upon the lake.

The first project provided for the construction of parallel jetties.

These jetties have had to be rebuilt and extended from time to time so as to keep pace with increasing requirements, and dredging has been resorted to to secure a greater depth than the natural currents would afford.

In compliance with the requirements of the river and harbor act of June 3, 1896, a survey of this harbor was made and a new project prepared for its improvement. This project provided for the construction of two breakwaters converging toward the lake, having an opening between them 500 feet in width, in prolongation of the axial line in the jettied channel. It also provided for rebuilding the jetties and for dredging the protected areas to a depth of 20 feet.

The new project was formally adopted by the river and harbor act of March 3, 1899, and provision was made for its execution by a continuous contract. The total amount expended prior to the adoption of the present project was \$292,204.77, and the amount expended upon the new project from the time of its adoption to June 30, 1903, was \$180,493.31.

For the execution of the new project proposals were invited separately for the dredging and for the construction and repair work. The contract for the dredging was awarded and was duly executed. The lowest bids obtained for the construction and repair work were such as to render it impossible to complete the work within the limit fixed by law.

The act of June 6, 1900, authorized contracts to be entered into for such portion of the work as the funds available would allow, at a cost not to exceed a 10 per cent increase over the original estimates. Under this authority a contract was made for the construction of all of the proposed works except the east breakwater. This contract was in force at the beginning of the fiscal year.

In the original plan, in order to make use of about 140 linear feet of the existing east jetty, which was then in a comparatively good state of preservation, it was proposed to leave the channel at its original width of 200 feet. As the channel was not straight this would render it inconvenient and perhaps inadequate; at least such was the opinion of the vessel interests and of the citizens of Lorain. Accordingly, the plan was changed so as to move the east jetty 100 feet eastward and increase the width of the channel from 200 to 300 feet. A supplementary contract was entered into with the contractor on August 8, 1901, and was approved by the Secretary of War, the funds being sufficient to permit of this alteration of the plan.

At the end of the fiscal year a total length of 1,135 feet of crib substructure for the jetties had been built and sunk in place, making the similar work previously done a length of 2,127 feet, which completes all of the work of this character proposed. In addition, 729 linear feet of concrete superstructure had been built on the east jetty. The timber cribs for the pier heads of the breakwater had been partially constructed and 9,212 tons of stone had been deposited in the breakwater. The progress made by the contractor is not satisfactory; 53.3 per cent of the working time allowed for the contract has expired, while but 37.4 per cent of the work has been completed. A more rapid rate of progress will be necessary to insure the completion of the work within the required time.

There remains 645 linear feet of the west jetty, a structure composed of cribs with timber superstructure, for the repair and maintenance

of which no provision was made in the project. The superstructure is rapidly decaying, and will soon be entirely unserviceable. Provision should be made in the way of maintenance for replacing this timber work by a proper concrete top. The estimated cost of this work, including inspection and supervision, is, in round numbers, \$50,000.

In order to complete the east breakwater an expenditure of \$190,000, also in excess of the funds now provided by law, will also be necessary. Provision for both of these works is now desirable.

The United States Steel Corporation is greatly extending and developing its plant at Lorain, involving a very large expenditure of money, and the city of Lorain has appropriated \$200,000 for widening and straightening Black River inside the shoreline.

The commerce of Lorain for the calendar year 1902 amounted to 2,549,496 tons, an increase of nearly 1,500,000 tons over that of the previous year. Ten ships were built at this harbor during the year with an aggregate tonnage of nearly 45,000 tons.

July 1, 1902, balance unexpended.....	\$406, 832. 74
Amount appropriated by sundry civil act approved March 3, 1903.	9, 000. 00

	415, 832. 74
June 30, 1903, amount expended during fiscal year.....	106, 326. 05

July 1, 1903, balance unexpended	309, 506. 69
July 1, 1903, outstanding liabilities	5, 602. 19

July 1, 1903, balance available.....	303, 904. 50
--------------------------------------	--------------

July 1, 1903, amount covered by uncompleted contracts.....	290, 303. 48
--	--------------

{ Amount (estimated) required for completion of existing project.....	356, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance in addition to the balance available July 1, 1903.....	" 355, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R R 6.)

7. *Cleveland Harbor, Ohio.*—The harbor of Cleveland, Ohio, consists of two distinct parts. The main portion, which is used for business purposes, is in the navigable portion of the Cuyahoga River, and a branch known as the "Old River Bed," all inside of the present shore line. All of the channel above the bridge of the Lake Shore and Michigan Southern Railway, which occupies a position practically coincident with the shore line of 1825, has been improved and maintained under the direction of the city authorities.

In 1826, when improvements were first undertaken, the mouth of the river was about 700 feet west of its present location. The plan of improvement contemplated rectifying the channel so that it would lead more directly into the lake, and making the new location permanent by jetties to confine the channel and concentrate the action of the current upon the bar.

The piers were repaired and extended, parts were rebuilt, and the channel was made deeper and maintained by dredging as necessities arose, with no change in the general method of improvement until 1875, at which time the total expenditure had been \$348,881.61.

^a Of this amount, \$166,000 is for continuing-contract work authorized by the river and harbor acts approved March 3, 1899, and June 6, 1900 (emergency act).

In 1875 a project was adopted for a breakwater in 5 fathoms of water. The west breakwater was commenced in 1876 and completed in 1883, a total length of 7,130 feet. The east breakwater was commenced in 1888 and continued at intervals until 1893, when its length was 2,494.5 feet. In 1895 an opening of 200 feet was made in the shore arm of the west breakwater as a sanitary measure. In 1896 a project for completing the improvement was approved by Congress, and contracts for the work were authorized, at a total cost not to exceed \$1,354,000. These improvements involve the completion of the east breakwater, covering an extension of about 3,000 feet; removing superstructure of the old west breakwater to a depth of 2 to 3 feet below water level and replacing it with a superstructure of concrete masonry; reinforcing the cribs below the masonry; sheathing the face of east breakwater; removing and rebuilding the east and west piers, and widening the mouth of the river.

In 1899 a project was prepared and was authorized by the river and harbor act of that year for deepening the channel and sheltered area by dredging to a depth of 21 feet. This project was enlarged by the act of June 13, 1902, to permit the dredging to be carried to a depth of 25 feet, at an estimated cost of \$478,400. The sum of \$115,000 has been expended or is contracted for toward the execution of this project.

A new project (see Report of Chief of Engineers, 1901, pp. 3289 to 3293, inclusive) was authorized by the act of Congress of June 13, 1902, and provides for improving and enlarging the entrance to the harbor and for extending the breakwater eastward to Gordon Park, in the city of Cleveland, a distance of about 16,000 feet, at a total estimated cost of \$4,481,456, and the act authorized an expenditure of \$2,800,000 for prosecuting this project.

The total of all expenditures for improving Cleveland Harbor from 1825 to June 30, 1903, was \$2,801,240.50.

This expenditure has covered the cost of construction of the works under the earlier projects and their maintenance up to the time that the project was enlarged. It has also sufficed for the completion of the project of 1896, with the exception of a small amount of jetty extension and dredging near the mouth of the Cuyahoga River and southward of the Lake Shore Railway bridge. This work, which would have cost about \$35,000, could not be carried out because the United States never obtained title to the land which would have to be dredged away. The improvement lies within the original shore line and may well be left to the care of the city of Cleveland. Its execution by the United States is not now recommended.

A few hundred feet of the concrete superstructure of the west breakwater remains to be completed, and a length of about 270 feet of the east breakwater extension, being a portion of the shore arm, has not been built, because it was forbidden by the last river and harbor act. Some repair work to the east breakwater remains to be done and is now being executed by hired labor. This will finish the work provided for by the project of 1896. The expenditure authorized will be ample for the purpose.

During the fiscal year ending June 30, 1903, \$121,978.82 was expended for the continuation of the construction of the concrete top on the west breakwater, for dredging, for repairs to the east breakwater by hired labor, and for the commencement of work under the new project.

At the beginning of the fiscal year work was being carried on under

contract for the repair and completion of the east breakwater under the project of 1896. As the further extension of this work was forbidden by Congress, the contract was terminated by a supplementary agreement.

The river and harbor act of June 13, 1902, appropriated \$500,000 toward the execution of the new project, and authorized an expenditure of \$2,300,000 in addition thereto. As stated in detail in the report of the district engineer, Appendix R R 7, herewith, contracts have been made for constructing the new entrance and for extending the breakwater eastward. Only a moderate amount of work has been accomplished up to June 30 of the present fiscal year, but extensive preparations have been made, and satisfactory progress hereafter is anticipated.

The work of improving the harbors on Lake Erie, and particularly the harbor of Cleveland, is inconvenienced by the fact that the United States owns no water front or wharf room for the storage of material and plant. The United States does possess in the city of Cleveland a fine tract of ground fronting the new harbor at the foot of Erie street. The property is used for a marine hospital and it has a water front of about 700 feet. This will be in the center of the harbor provided by the new project. The United States should by no means part with this water front, but might well improve it by the construction of suitable wharves for the use not only of the Engineer Department, but of the Custom-House, Revenue-Cutter, and Light-House services, and the vessels of the United States Navy.

The receipts and shipments at Cleveland for the calendar year 1902 amounted to more than 10,000,000 tons, an increase of more than 2,500,000 tons over the business of the previous year.

July 1, 1902, balance unexpended	\$800,369.93
Amount appropriated by sundry civil act approved March 3, 1903	227,500.00
Collections on account of damages to west pier:	
September 6, 1902	\$77.44
March 6, 1903	200.00
	277.44
	1,028,147.37
June 30, 1903, amount expended during fiscal year	121,978.82
July 1, 1903, balance unexpended	906,168.55
July 1, 1903, outstanding liabilities	34,789.33
July 1, 1903, balance available	871,379.22
July 1, 1903, amount covered by uncompleted contracts	2,593,652.31

(Amount (estimated) required for completion of existing project	^a 4,285,356.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	^b 872,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R R 7.)

8. *Fairport Harbor, Ohio.*—This harbor is situated at the mouth of Grand River, where it enters Lake Erie, about 32 miles eastward

^a Includes on account of project of 1896, \$168,000; on account of dredging, \$363,400; on account of project of 1902, \$3,753,956.

^b Of this amount, \$500,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

from the harbor of Cleveland. Before the improvement was undertaken the depth across the bar at the mouth of the river was variable and uncertain and quite insufficient for the needs of commerce.

The first improvement was undertaken in 1825, and the original project provided for the construction of parallel jetties of crib work filled with stone, placed about 200 feet apart and extending outward across the bar and into the lake. The jetties were extended and have been repeatedly repaired and rebuilt as necessities required, and the channel has been deepened and redredged many times.

In 1896 the project was enlarged to provide for the construction of two breakwaters converging toward the lake, the outer ends being in deep water and sufficient space being left between them to afford an easy entrance to the jettied channel. These breakwaters were to terminate in pierheads 50 feet square, and the total length of the west breakwater was to be 2,050 feet and the east breakwater 1,350 feet.

The total amount expended to June 30, 1903, was \$532,432.31.

The expenditure has resulted in the construction of a west jetty 2,370 feet in length, and an east jetty 1,765 feet in length from the original shore line; also in the construction of 828 linear feet of the shoreward end of the west breakwater. All of these structures are of timber cribs filled with stone and surmounted by continuous timber superstructures. These works have been repaired and maintained, and a large amount of dredging has been done to improve and preserve the channel.

An extensive sand beach lies immediately west of the harbor of Fairport, and the material of this beach, when moved under the combined action of waves and shore currents, forms extensive bars beyond the end of the jetties, which require annual dredging to maintain navigation. To prevent this, and diminish the quantity of dredging necessary for the future maintenance of the channel, it is desirable to modify the project so far as to provide for connecting the inner end of the west breakwater with the shore.

The most suitable form of connection would be a simple rubble mound structure. The plan should further be modified by changing the direction of the portion of this breakwater which remains to be built so as to make it parallel to the axis of the jettied channel. This will place its outer extremity farther westward and afford a wider opening for the use of vessels, and thus prevent the bar which will probably form beyond it from immediately obstructing the channel. If the modified rubble mound is used throughout the work, the cost of completing the west breakwater will be \$273,000. This will still leave a sufficient sum from the estimate for completion (\$480,000) to build the east breakwater, if this work is finally found to be desirable and necessary.

The river and harbor act of June 13, 1902, appropriated \$200,000 for continuing the improvement and for maintenance of this harbor. The sum of \$25,000 is authorized to be applied toward the purchase of a hydraulic dredge. The remainder is being expended for the maintenance of existing works, and will provide for completely rebuilding 595 linear feet of the inner end of the east jetty and 575 feet of the inner end of the west jetty, and for repairing and strengthening the remaining portions of these works. This repair work is urgently necessary, as the maintenance of the jetties is essential to the preservation of the harbor. The work is being executed under contract, and will probably be completed by the end of the present working season.

The necessary dredging has been resorted to to maintain a depth of 21 feet in the channel.

The receipts and shipments at this harbor during the calendar year 1902 amounted to 2,330,480 tons, an increase of nearly 700,000 tons over the business of the previous year.

July 1, 1902, balance unexpended	\$200, 120. 07
June 30, 1903, amount expended during fiscal year	31, 896. 85
July 1, 1903, balance unexpended	168, 223. 22
July 1, 1903, outstanding liabilities	3, 579. 36
July 1, 1903, balance available	164, 643. 86
July 1, 1903, amount covered by uncompleted contracts.....	110, 005. 49
{ Amount (estimated) required for completion of existing project	480, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	253, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix R R 8.)

9. *Ashtabula Harbor, Ohio.*—This harbor is situated at the mouth of the Ashtabula River, where it enters Lake Erie, at a point about 54 miles eastward from the harbor of Cleveland. In its natural condition the mouth of the river was obstructed by a bar upon which the depth of water varied according to the prevailing conditions of storms on the lake and freshets in the river. The greatest possible depth on the bar was 9 feet, this being the distance to the underlying rock near the shore line. The minimum depth probably did not exceed 2 feet.

The original project for improvement of this harbor was adopted in 1826, and provided for the construction of two parallel jetties extending outward from the shore line into the lake. The jetties have been repaired from time to time and extended, and the channel has been deepened by dredging.

In 1891 the depth in the channel was 17 feet, and the project was modified to provide for widening the jettied channel to 213 feet and to extend the jetties to 22 feet depth in the lake, and to dredge between them to a depth of 20 feet.

The river and harbor act of 1896 authorized a new project, which modifies the previous one in regard to the length of the jetties, and provides for the construction of two breakwaters converging toward the lake, the outer ends being about 400 feet apart and in water 29 feet deep.

The river and harbor act of March 3, 1899, authorized a continuous contract to be made for the construction of these breakwaters, at a cost not to exceed \$430,000.

The total amount expended to June 30, 1903, was \$910,085.67.

At this time the proposed work on the jetties had been completed and a section of 452 feet in length at the shoreward end of the west breakwater had been built. A continuous contract was entered into in June, 1900, for the completion of breakwaters. These were to be rubble mound structures of the standard type and to terminate at their outer extremities in timber crib pierheads surmounted by concrete and arranged to properly support the necessary lights at the harbor entrance.

At the end of the fiscal year June 30, 1902, about 26 per cent of the contract had been completed. It was continued throughout the present

fiscal year, and on June 30, 1903, the work was 60 per cent completed. No portion of the rubble mound had at that time been brought above the surface of the water. The work is being carried forward in a satisfactory manner, and it seems probable that it will be completed within the contract time.

In the spring of 1903 it was found that the usual shoaling and bar formation had taken place. An emergency contract was resorted to to secure the restoration of the channel, and the work was completed at a field cost of \$3,122.90, which secured the removal of 10,373 cubic yards of sand and silt.

The river and harbor act of June 13, 1902, appropriated \$200,000 for continuing the improvement and maintenance of this harbor. The sum of \$20,000 of this amount was authorized to be applied toward the purchase of a hydraulic dredge, and it was intended to apply the greater portion of the balance to the repair and rebuilding of the west jetty, which was in a ruinous condition. While the plans for this work were in course of preparation the Secretary of War, under authority of law, authorized the Pittsburgh, Youngstown and Ashtabula Railroad Company, which is owned or controlled by the Pennsylvania Railroad Company, to completely remove this west jetty and to replace the same by a bulkhead 60 feet farther west, thus proportionally widening the channel. This company owns the land lying immediately west of the jetty. The interests of the United States were preserved by requiring the company to provide a proper place for the location of the range lights which had formerly been placed on the jetty. This action completely relieves the United States of the necessity of rebuilding this jetty and of maintaining it in the future, and it leaves available at least \$150,000 for improvement elsewhere.

It is believed that this amount can be applied most advantageously to the extension of the west breakwater 1,500 feet shoreward by a modified rubble mound construction. This extension would permit of the construction on the lake front of wharves and slips which are greatly needed for the business of the harbor, and it is recommended that Congress authorize the application of the funds to the extension of the west breakwater as proposed.

The commerce of Ashtabula is very great and is continually increasing. During the calendar year 1892 the receipts and shipments exceeded 7,000,000 tons, an increase of more than 1,000,000 tons over the business of the previous year, which was the greatest heretofore reported.

July 1, 1902, balance unexpended.....	\$468, 988. 02
Amount appropriated by sundry civil act approved March 3, 1903.....	118, 000. 00
December 4, 1902, proceeds of sales of Government property.....	1. 00
June 30, 1903, amount expended during fiscal year	586, 989. 02
July 1, 1903, balance unexpended	148, 814. 03
July 1, 1903, outstanding liabilities	438, 174. 99
July 1, 1903, balance available	13, 657. 95
July 1, 1903, balance available	424, 517. 04
July 1, 1903, amount covered by uncompleted contracts	183, 620. 64
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	10, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1890.	

(See Appendix R R 9.)

10. *Conneaut Harbor, Ohio.*—This is the most easterly harbor in the Cleveland district. It is at the mouth of Conneaut Creek, in the northeastern part of the State of Ohio and near the Pennsylvania line. In its natural condition the creek was obstructed by a bar at its mouth, over which the average depth of water did not exceed 2 feet.

The first improvement was undertaken in 1829, and consisted in the construction of parallel jetties of timber cribs filled with stone extending outward into the lake so as to prolong the natural banks of the river and to confine the current and cause it to wash away the bar. Only a moderate degree of improvement was sought, and the greatest depth ever obtained under this project did not exceed 12 feet.

After 1870 the appropriations became small and irregular, and in 1880 they ceased altogether. Up to this time the total expenditures had been \$112,629.39. No appropriation at all was made for the harbor from 1880 until 1892. At the latter date the jetties were in a decayed and ruinous condition, and the channel had filled up with sand and silt and had practically reverted to its original condition. The harbor was used only by a few small sailing craft engaged in fishing.

A new project was prepared and approved in 1892, and provided for the construction of parallel jetties 200 feet apart and extending outward to a depth of 17 feet in the lake. The project was added to in 1896 to provide for the construction of two detached breakwaters converging toward the lake so as to shelter the entrance to the jettied channel, and the project provided for securing a depth of 20 feet in the channel and sheltered area.

The estimated cost of the new project, exclusive of maintenance, was \$610,000, and the amount expended upon it, including maintenance to June 30, 1903, was \$230,726.99. This sufficed for the construction of 1,006 linear feet of the jetties, 1,027 linear feet of the west breakwater, and for securing and maintaining a channel 20 feet deep between the jetties and outward to deep water in the lake.

The river and harbor act of June 13, 1902, authorized the expenditure of \$450,000 for the prosecution of the approved project. Of this sum \$10,000 was to be set aside toward the purchase of a hydraulic dredge.

In addition to the construction of the new work described in the project of 1896, it was necessary, in the way of maintenance and to make the entire improvement of a permanent character, to replace 412 linear feet of sheet-piling work at the shoreward end of the east jetty by a permanent crib structure with a concrete top; also to replace the old timber superstructure on 1,006 linear feet of existing jetty by a concrete top of standard design. These works of maintenance were included in the plans for the expenditure of the appropriation above mentioned. Proposals for the execution of the work were invited, and a contract was entered into with the Donnelly Contracting Company, of Buffalo, N. Y., which company was the lowest bidder.

At the prices obtained in the contract the funds will be sufficient to complete all of the improvement proposed except a length of 250 feet at the shoreward end of the east breakwater. This breakwater is to be a rubble mound of the standard type. To complete it to its full length will cost, including inspection, \$40,000, and the appropriation of this amount is recommended for the completion of project. The contract was entered into so late in the season of 1902 that no work under it was practicable until the spring of 1903. Up to the 30th of

June the contractor had prepared the foundation for the completion of the west breakwater and had commenced the removal of a portion of the superstructure of the jetties as a preliminary to replacing it with concrete. He had also installed a plant and collected lumber at Fairport with a view to building the cribs at that place.

The commerce at Conneaut continues to exhibit a remarkable growth. In 1893 it amounted to nothing. In 1902 it was 5,286,611 tons, an increase of 1,331,533 tons over that of the previous year.

July 1, 1902, balance unexpended	\$201, 813. 41
Amount appropriated by sundry civil act approved March 3, 1903	10, 000. 00
	211, 813. 41
June 30, 1903, amount expended during fiscal year	7, 472. 20
	204, 341. 21
July 1, 1903, balance unexpended	204, 341. 21
July 1, 1903, outstanding liabilities	264. 28
	204, 076. 93
July 1, 1903, balance available	204, 076. 93
July 1, 1903, amount covered by uncompleted contracts	432, 646. 84
	240, 000. 00
{ Amount (estimated) required for completion of existing project	
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1905, in addition to the balance available July 1, 1903:	
{ For works of improvement	
{ For maintenance of improvement	
{ \$240, 000. 00	
{ 6, 000. 00	
{ 246, 000. 00	
{ Submitted in compliance with requirements of sundry civil act of June	
{ 4, 1897, and of section 7 of the river and harbor act of 1899.	
{ (See Appendix R R 10.)	

11. *Removing sunken vessels or craft obstructing or endangering navigation.*—*Steamer George Dunbar.*—The steamer *George Dunbar* foundered in Lake Erie, about 6 miles east of Middle Island light-house, on the 29th of June, 1902. It formed an obstruction to navigation, and an allotment of \$500 was made for the removal of the masts and spars. This was done, and on the 24th of October it was reported that all portions of the wreck had been removed to about a depth of 30 feet.

The allotment sufficed for the work.

Tow barge L. L. Lamb.—This vessel was wrecked in attempting to enter the harbor of Fairport, Ohio. It is less than a mile distant from the harbor entrance, and was reported as an obstruction to navigation. An allotment of \$500 was made for its removal, but no work has yet been done upon it except to examine it and buoy it.

Steamer Lockwood.—This vessel was lost in Lake Erie in October, 1902. Some of the rigging and spars showed above water, and it was regarded as a dangerous obstruction to navigation. An allotment of \$500 was made to search for it. The wreck was found and buoyed. There was 55 feet of water over it everywhere except a broken mast, which comes within about 7 feet of the water surface. It is intended that this shall be removed.

In addition to the foregoing the steamer *Quito* went ashore and was wrecked eastward of the harbor of Lorain. The schooner *Mosher* was wrecked on Starve Island Reef. The schooner *Horace H. Badger* was wrecked just outside of the breakwater at Cleveland, Ohio. The steamer *Chas. H. Davis* was wrecked about three-fourths of a mile northwest of the entrance to Cleveland Harbor. All of these wrecks

have been examined and none of them were found to be obstructions to navigation.

The wreck of a floating crib was found in the channel in Maumee Bay in the spring of 1903. This was removed promptly and the cost was paid by a firm of contractors who were found responsible for permitting it to go adrift.

The expenditures during the year on removal of wrecks is \$1,562.76.

(See Appendix R R 11.)

IMPROVEMENT OF ERIE HARBOR, PENNSYLVANIA, AND OF CERTAIN RIVERS AND HARBORS IN WESTERN NEW YORK.

This district was in the charge of Maj. T. W. Symons, Corps of Engineers, to May 7, 1903, and of Maj. Theo. A. Bingham, Corps of Engineers, since that date. Division Engineers, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general, United States Army, retired), to February 25, 1903, and Col. Amos Stickney, Corps of Engineers, since that date.

1. Harbor at Erie, Pa.—In its original condition the harbor of Erie was landlocked, the only entrance being to the east. The channel was narrow and tortuous, variable in position, with a depth of about 6 feet.

The original project, approved March 26, 1824, provided for closing the eastern end of the harbor by means of a breakwater in which there should be an opening 200 feet wide, and for extending to deep water in the lake two parallel piers, one on each side of the opening. The project also includes the necessary work of dredging to keep the channel open, making the necessary repairs to existing structures, and maintaining Presque Isle Peninsula.

This project was modified by the river and harbor act of March 3, 1899, and now requires the harbor basin and entrance channel to be dredged to a depth of 20 feet at mean lake level, the north and south piers to be provided with concrete superstructure and extended 500 and 1,000 feet, respectively, and four protection jetties to be built along the outer shore of Presque Isle Peninsula.

The estimated cost of completing the modified project was \$377,000.

At the close of the past fiscal year, under the modified project, 1,210 feet of wooden superstructure on north pier had been replaced with concrete; the north pier had been extended 510 feet; one protection jetty had been built; the channel dredged 20 feet deep; the basin dredged 20 feet deep, except a strip 250 feet wide along the eastern end and under the contract in force to be completed in 1903; the wooden superstructure on all of the south pier, 1,217 feet, was being replaced with concrete, one protection jetty being built, and the north pier being ripped up.

Work proposed for the ensuing fiscal year includes the extension of the south pier; completion of the basin excavation; building one, and perhaps two, protection jetties; and under maintenance, the replacing of 750 feet of decayed wooden superstructure on the north pier with concrete, which is very urgently needed.

The total amount expended on the harbor to June 30, 1903, was \$1,106,967.28. It is impracticable to separate the cost of construction and maintenance.

The maximum draft that could be carried June 30, 1903, at mean lake level over the shoalest part of the locality under improvement

was 18½ feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage, for the past ten years, as compiled from Annual Reports of the Chief of Engineers:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1893.....	1,677	1,701,542	1898.....	2,939	3,939,019
1894.....	2,687	3,069,545	1899.....	3,200	3,961,794
1895.....	2,936	3,323,672	1900.....	2,709	3,403,312
1896.....	3,100	3,323,672	1901.....	3,405	3,204,325
1897.....	3,133	4,061,984	1902.....	2,809	3,573,734

For more extended information and sketches see Annual Report of the Chief of Engineers for 1900, page 4108 et seq.

A chart of Erie Harbor is issued in the series of charts for the survey of the Northern and Northwestern Lakes, index No. 91.

July 1, 1902, balance unexpended\$143,858.51
 June 30, 1903, amount expended during fiscal year 54,241.67

July 1, 1903, balance unexpended 89,616.84

July 1, 1903, amount covered by uncompleted contracts 65,294.36

{ Amount (estimated) required for completion of existing project..... 127,000.00
 { Amount that can be profitably expended in fiscal year ending June 30,
 { 1905, for works of improvement and for maintenance, in addition to
 { the balance unexpended July 1, 1903 137,000.00
 { Submitted in compliance with requirements of sundry civil act of June
 { 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix S S 1.)

2. *Harbor at Dunkirk, N. Y.*—The harbor at Dunkirk is naturally a simple indentation of the south shore of Lake Erie. It lies between Point Gratiot on the west and Battery Point on the east. Between the two points is a distance of 9,600 feet, and the maximum breadth of the bay behind the line of the two headlands is 3,600 feet. The general depth of water in the bay was about 10 feet. The bay is underlaid with rock at an average depth of 15 to 16 feet. The object of the improvement is to form an artificially protected harbor in this indentation or bay.

The existing project, approved November 30, 1870, provides for a detached breakwater 2,860 feet long, one part of which, 2,300 feet long, was to be nearly parallel with the shore; the other part, 560 feet long, to be nearly parallel with the axis of the channel entrance.

This breakwater and the pier already built were to form the harbor, and the old channel was to be enlarged to 170 feet wide and 13 feet deep.

All the works now existent at Dunkirk have been built according to this plan. The project adopted by Congress and provided for by the river and harbor act of June 3, 1896, consisted in completing the breakwater as before planned by the addition of 360 feet to its eastern end and adding the channel arm, 560 feet long, and in addition thereto dredging an entrance channel and a harbor basin, containing in all about 65 acres, to a depth at mean lake level suitable for vessels drawing 16 feet. This work was completed in 1898 at a total cost of \$389,060.55.

The total amount expended on the harbor to June 30, 1903, was \$965,555.35.

It is impracticable to separate the cost of construction and maintenance.

During the past fiscal year the substructure of the timber portion of the west pier was repaired where breached and decayed deck on the breakwater repaired.

The old timber breakwater and pier need repairs, which can most advantageously be done with concrete, and all funds available and which may be appropriated will be applied to such repairs in connection with maintenance of the channel.

The maximum draft that could be carried June 30, 1903, at mean low water over the shoalest part of the locality under improvement was 16 feet, and the usual variation of level of water surface is about 2 feet.

The following table gives the total arrivals and departures, including tonnage for the past ten years, as compiled from the Annual Reports of the Chief of Engineers:

Year.	Number.	Tonnage.	Year.	Number.	Tonnage.
1893.....	137	19,158	1898.....	180	22,005
1894.....	76	18,763	1899.....	192	82,783
1895.....	69	15,650	1900.....	278	107,316
1896.....	42	12,160	1901.....	171	49,148
1897.....	197	12,160	1902.....	143	33,435

For more extended information and map, see Annual Report of the Chief of Engineers for 1898, page 2748 et seq.

For report of survey and estimate for an east breakwater, see House Document No. 74, Fifty-sixth Congress, first session.

A chart of Dunkirk Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index Number 90.

July 1, 1902, balance unexpended	\$26,620.36
June 30, 1903, amount expended during fiscal year	4,588.33
July 1, 1903, balance unexpended	22,032.03

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix S S 2.)

3. *Harbor at Buffalo, N. Y.*—Buffalo Creek was the original harbor of the port of Buffalo. In its original condition it was shallow and closed by a gravel bar for most of the year. The original project for the improvement of this harbor was adopted in 1826, and provided at first for the construction of piers on the north and south sides of Buffalo Creek. Subsequently a masonry sea wall, 5,400 feet long, was built along the lake shore south of the harbor entrance, and a sand-catch pier of piles and stone 879 feet long built out from the shore.

In 1868 a detached breakwater, about 2,500 feet lakeward from the shore line, to extend south a distance of 4,000 feet, was proposed and adopted. In 1874 it was determined to extend this breakwater to a total length of 7,600 feet. This breakwater has now its full proposed length, the final extension of 806 feet having been built in 1893. It

runs parallel with the shore, and about half a mile distant from it. In 1874 it was also proposed to build a shore arm to the breakwater, the inshore end to consist of pile work near shore, and crib work in deeper water. Upon reaching the 16-foot contour line in the lake this shore arm was planned to continue in a direction making an angle of 45 degrees with the shore and to overlap the south end of the breakwater, leaving an opening of 150 feet. In 1886 a project was approved for replacing with concrete the wooden superstructure as soon as it became badly decayed. To date 4,894.13 feet has been so replaced.

In 1895 a new project was adopted for the improvement of Buffalo Harbor. The project consists of the abandonment of the shore arm and the extension of the breakwater from its present southern end to Stony Point. The report of the Board and details of its plans are published in the Annual Report of the Chief of Engineers for 1895, page 3153 et seq. The river and harbor act of June 3, 1896, added to the project of the Board of Engineers by providing for the construction of a further length of the sand-catch pier, extending it to the established pierhead line.

The project now in force for the improvement of Buffalo Harbor is:

(a) To maintain existing structures, making the requisite minor repairs, and replacing the wooden superstructure of the breakwater with concrete when necessary.

(b) To build an extension of the breakwater from its present southern end to Stony Point, leaving the necessary openings for the convenience of commerce.

(c) To extend the sand-catch pier to the established pierhead line.

This project has been practically completed, except the maintenance of existing structures, etc., as noted in (a).

The breakwater extension to Stony Point was practically completed in December, 1902. A storm on December 10-15, 1902, caused the soft clay bottom under a part of the stone breakwater to give way and about 1,300 feet of the structure settled about ten feet, or to water surface. The building up of this settled work and further strengthening of the stone breakwater and timber-crib concrete portion adjoining it was in progress at the close of the fiscal year, and will be continued during the season of 1904, if funds are appropriated for the needed work.

The total amount expended by the United States on the improvement of Buffalo Harbor to June 30, 1903, was \$4,887,092.25. It is impracticable to separate the cost of construction and maintenance.

A magnificent harbor has been obtained. The principal features are north and south piers and the entrance channel between them at the mouth of Buffalo Creek, in which most of the business of the port is done, and the outer breakwater system, consisting of four sections of breakwater of an aggregate length of 22,611 feet, inclosing an outer harbor $4\frac{1}{2}$ miles long and over one-half mile wide. This breakwater system comprises 8,894 linear feet of breakwater finished in concrete, 7,261 linear feet of the stone or rubble mound type, and 6,456 feet of timber-crib breakwater, eventually to be finished in concrete.

The maximum draft that could be carried June 30, 1903, at mean water level over the shoalest part of the locality under improvement was 20 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

In his report upon this improvement the local officer calls attention to the need of a storage ground, workyard, and slip for loading and

unloading timber and other materials used in harbor construction. The Government has no place for storage and dockage of this character, and the rental of property for the purpose is neither feasible nor desirable in a crowded port like Buffalo. The cost of providing such adequate storage facilities is estimated at \$73,600, and it is recommended that the existing project be extended by Congress so as to provide for these facilities at the cost stated.

The commerce of Buffalo is enormous. During the year 1902 arrivals and departures of vessels by lake and river aggregated in number 9,814, and in tonnage 11,656,280.

The arrivals and departures of canal boats by the Erie Canal were 6,550. The principal receipts by lake and river were wheat, corn, flour, oats, iron ore, lumber, copper, pig iron, glucose, lard, and pork. The total receipts amounted to 7,909,323 tons.

The shipments by lake were principally coal, sugar, salt, and cement, and aggregated 1,817,079 tons.

For comparison, the following table is given, showing arrivals and departures by lake and canal and the tonnage for the past five years:

Year.	Lake.		Canal.	
	Number.	Tonnage.	Number.	Tonnage.
1898	10,708	12,040,993	8,338	1,115,407
1899	10,417	10,481,043	7,506	1,033,170
1900	9,973	10,216,407	6,482	888,318
1901	11,599	10,454,680	6,812	1,653,334
1902	9,814	11,656,280	6,550	833,619

	Arrivals and departures.		Receipts of freight.		Shipments of freight.	
	1901.	1902.	1901.	1902.	1901.	1902.
Lake and river	11,599	9,814	6,619,390	7,909,323	3,600,319	1,817,079
Canal	6,812	6,550	340,234	825,310	1,313,100	508,309
Total	18,411	16,364	6,959,624	8,734,633	4,913,419	2,325,388

Total shipments and receipts, 1901, 11,873,043 tons; 1902, 10,760,021 tons.

Work proposed for the ensuing fiscal year, which is necessary to make the improvement available and to extend its benefits, is as follows:

First. To finish the reenforcement of the extension of the breakwater south to Stony Point.

Second. To repair and maintain other existing structures.

For more extended information and map see Annual Report of the Chief of Engineers for 1898, page 2756 et seq.

A chart of Buffalo Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index No. 123.

July 1, 1902, balance unexpended \$419,670.29

June 30, 1903, amount expended during fiscal year 337,273.17

July 1, 1903, balance unexpended 112,397.12

July 1, 1903, amount covered by uncompleted contracts Indefinite.

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903 250,000.00
 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix S S 3.)

4. *Lake Erie entrance to Black Rock Harbor and Erie Basin, New York.*—This is a new work, the adopted project contemplating the formation, by dredging and rock removal, of a channel 2,300 feet long, 400 feet wide, and 23 feet deep at mean lake level, except where bed rock is found at a depth of 22 feet, from Buffalo main entrance channel to Erie Basin, and a branch channel and basin 1,920 feet long, 500 feet wide, and 23 feet deep at mean lake level, to Black Rock Harbor, at an estimated cost of \$814,643. The act of June 13, 1902, authorizes the letting of a continuing contract in the sum of \$614,643, exclusive of amount appropriated, for completing the work.

The plan of improvement is printed in House Document No. 125, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 3345.

The work was fairly started at the close of the fiscal year, under a continuing contract for the whole work, to be completed under certain conditions of contract on or before December 31, 1906.

The total amount expended on the project to June 30, 1903, was \$705.50.

The maximum draft that could be carried over the shoalest part of locality under improvement at mean lake level June 30, 1903, was 10 feet, and the usual variation of level of water surface of from 3 to 4 feet, with maximum variation much greater.

For commercial statistics see report on Buffalo Harbor, New York.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the Falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index No. 123.

July 1, 1902, balance unexpended	\$200,000.00
Amount appropriated by sundry civil act approved March 3, 1903	200,000.00
	400,000.00
June 30, 1903, amount expended during fiscal year	705.50
July 1, 1903, balance unexpended	399,294.50
July 1, 1903, amount covered by uncompleted contracts	802,250.00
{ Amount (estimated) required for completion of existing project	414,643.00
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1905, in addition to the balance unexpended July 1, 1903	200,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
{ 4, 1897.	

(See Appendix S S 4.)

5. *Buffalo entrance to Erie Basin and Black Rock Harbor, New York.*—The first appropriation, \$50,000, for this improvement was made March 3, 1899, and an appropriation of \$191,701.25 was made June 6, 1900, to complete the work.

The adopted project is to build a breakwater about 2,200 feet long, covering and protecting the entrance to Erie Basin and Black Rock Harbor and the lake front of Buffalo Harbor between the State structures known as the Erie Basin breakwater and the Bird Island pier.

The project has been completed and the breakwater is the northerly section of the outer breakwater system forming the outer harbor of Buffalo.

The amount expended to June 30, 1903, was \$238,436.81, of which \$236,278.10 was for construction and \$2,158.71 was for maintenance.

The maximum draft that could be carried over the shoalest part of

the locality under improvement at mean water level June 30, 1903, was 20 feet, and the usual variation of level of water surface is from 3 to 4 feet, with maximum variation much greater.

For commercial statistics see report on Buffalo Harbor.

For more extended information see Annual Report of the Chief of Engineers for 1897, page 3246 et seq., and for 1901, page 3324 et seq.

The locality is shown on a chart of Buffalo Harbor and Niagara River to the Falls, issued in the series of charts of the survey of the Northern and Northwestern Lakes, index number 123.

July 1, 1902, balance unexpended	\$3,264.44
July 1, 1903, balance unexpended	3,264.44

(See Appendix S S 5.)

6. *Tonawanda Harbor and Niagara River, New York.*—In its original condition the navigation of Niagara River from Lake Erie to Tonawanda was obstructed by several reefs and shoals, which materially limited the draft of vessels traversing it. The water in the harbor between Tonawanda Island and the mainland was shoal, and the river in some places had a very swift current.

The adopted project of April 11, 1888, is to remove obstructions so as to make a channel 400 feet wide and 18 feet deep at mean river level, which includes work at the following places:

- (a) On the Horseshoe reef at the entrance to Niagara River.
- (b) On the shoal at Strawberry Island,
- (c) At a few shoal places abreast of the lower end of Rattlesnake Island.
- (d) The full width of the river between Tonawanda Island and the mainland along the entire front of Tonawanda.

By the terms of the river and harbor act of June 3, 1896, the project was defined to include the river to the north line of the village of North Tonawanda.

The river and harbor act of June 13, 1902, makes the project include the "dredging of Tonawanda Harbor." By this is understood the portion of the Niagara River fronting the village of Tonawanda, Erie County, and of Tonawanda Creek up to the State dam, which additional improvement was recommended and approved under an examination and survey made under the river and harbor act of March 3, 1899, the report whereof is printed, with map, in House Document No. 143, Fifty-sixth Congress, first session, and in the Report of the Chief of Engineers, for 1900, without map, page 4152 et seq.

The cost of the work as estimated in 1891 was \$1,152,987.93. This did not include the work necessary between the foot of Tonawanda Island and the north line of the village of North Tonawanda, nor that required in the main river abreast of Tonawanda Island, to which the project was extended by the terms of the river and harbor act of June 3, 1896, but this estimate will cover that work.

It is further understood that the act of 1902 increases the estimate of cost amounting to \$1,152,987.93 by \$27,000, to provide for this additional improvement, making the present revised estimate of cost \$1,199,987.93.

The amount expended on the general project up to June 30, 1903, was \$472,555.28, all for excavation.

The channel through the Horseshoe reef and the channel through the reef at Strawberry Island has been completed to a depth of 18 feet and width of 400 feet.

Tonawanda Harbor has been dredged to a depth of 18 feet along nearly all the length of Tonawanda Island and mainland front, and a shoal at the foot of Tonawanda Island removed. About one-half of the required dredging in this harbor above the foot of Tonawanda Island has been completed.

The dredging of Tonawanda Creek to the State dam has been completed to the required depth of 18 feet.

The removal of shoals in the main river abreast of Tonawanda Island has been one-half completed.

The commerce of Tonawanda is large. During the year 1901 there were entered and cleared 1,671 lake craft, with a tonnage of 982,968 tons. The receipts were principally lumber, iron ore, and limestone, and aggregated 975,253 tons. The shipments from Tonawanda are entirely by Erie Canal.

The maximum draft that could be carried June 30, 1903, at mean water level over the shoalest part of the locality under improvement was 15 feet, and the usual variation of level of water surface was 2 feet.

Work proposed for the ensuing year necessary to make the improvement available includes the dredging of Tonawanda Harbor and dredging in Niagara River on the shoals abreast of Tonawanda Island, and at such other places as may be found necessary to complete the channel of the project above the foot of Tonawanda Island.

It is expected that this part of the channel from Lake Erie to the foot of Tonawanda Island can be completed with the funds available.

For more extended information see Annual Report of the Chief of Engineers for 1900, page 4139.

A chart of Niagara River to the Falls is issued in the series of charts of the Northern and Northwestern Lakes, index number 123.

July 1, 1902, balance unexpended	\$259, 407. 01
June 30, 1903, amount expended during fiscal year	49, 262. 29

July 1, 1903, balance unexpended	210, 144. 72
--	--------------

July 1, 1903, amount covered by uncompleted contracts	Indefinite.
---	-------------

Amount (estimated) required for completion of existing project	517, 287. 93
--	--------------

(See Appendix S S 6.)

IMPROVEMENT OF HARBORS ON LAKE ONTARIO AND OF ST. LAWRENCE RIVER AND HARBORS THEREON, NEW YORK.

This district was in the temporary charge of Maj. T. W. Symons, Corps of Engineers, to May 7, 1903, and of Maj. Theo. A. Bingham, Corps of Engineers, since that date. Division Engineers, Col. S. M. Mansfield, Corps of Engineers (now brigadier-general United States Army, retired), to February 25, 1903, and Col. Amos Stickney, Corps of Engineers, since that date.

1. *Harbors at Wilson and Oak Orchard, N. Y.*—(a) *Wilson Harbor.*—This harbor is at the mouth of Twelve-mile Creek. In its original condition there was a depth on the bar of 1 foot. In 1846 two piers were built by private enterprise about 400 feet into the lake.

The original project of 1873 for improvement by the General Government was to extend the piers to the 12-foot curve in Lake Ontario and to dredge a channel 12 feet deep between the piers and to deep water in the creek, at an estimated cost of \$90,000, increased in 1877

to \$100,000. January 10, 1900, the project was modified to obtain and maintain a depth of 10 feet at extreme low water, seven-tenths foot below zero of Oswego gauge or low water, without further extension of the piers, at least for the present.

The river and harbor bill of June 13, 1902, contained an item making an appropriation of \$4,500 for improving harbors at Wilson and Oak Orchard, N. Y. The distribution of this appropriation between the two harbors decided upon and approved was to allot one-half, or \$2,250 to each of the harbors, the allotment to Wilson Harbor to be expended in repairs to the piers and, if investigation showed it necessary, to dredge the entrance channel.

The amount expended to June 30, 1903, was \$72,925.89, of which \$15,538.44 was applied to maintenance of improvement.

During the fiscal year ending June 30, 1903, the most necessary repairs were made to the superstructures of both piers. No dredging of the channel was done, as the commerce of the harbor did not demand it.

The maximum draft that could be carried into this harbor at low water June 30, 1903, was 7 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this port for the years given:

	Tons.		Tons.
1891	1,296½	1900	653
1898	294½	1901	312
1899	124	1902	148

For more extended information and sketch see Annual Report of the Chief of Engineers for 1889, page 2395 et seq.

The local officer in his Annual Report for 1902 suggested, "owing to the insignificance of this port and its commerce, and its proximity to the Niagara River and Olcott, that it be abandoned as a port to be maintained by the United States."

The question of the desirability of continuing or modifying the project for improvement of Wilson Harbor has been referred, by the Committee on Rivers and Harbors of the House of Representatives, to the Board of Engineers created in accordance with section 3 of the river and harbor act of June 13, 1902. The report of this Board will be submitted to Congress not later than December 7, 1903. In the meantime there is submitted an estimate of \$29,000 for maintenance.

(b) *Oak Orchard Harbor.*—This harbor is at the mouth of Oak Orchard Creek, and in its original condition had about three feet of water on the bar.

The original project adopted in 1836 and finally revised in 1881 was to narrow the mouth of the creek to 200 feet by two breakwaters running along the lake shore and to make a 12-foot channel between parallel piers connecting with the breakwaters, from deep water in the creek to the 12-foot curve in the lake. The estimated cost is not known.

The piers were built, west 1,300 feet long, east 920 feet long, and a shore protection added, extending 90 feet easterly from the shore end of the east pier. The channel was dredged about 150 feet wide and

11½ feet deep at low water between the piers. At the ends of the piers where the rock excavation ceased the depth is 9½ feet at low water (zero of Oswego gauge) over the rock.

These piers are intact but decayed, and the channel fills in rapidly with sand. No work was done on this harbor for several years (from 1895 to 1902), no funds being available.

The river and harbor act of June 13, 1902, contained an item appropriating \$4,500 for improving Wilson and Oak Orchard harbors. The distribution of the appropriation between the two harbors decided upon and approved, was to allot one-half, or \$2,250, to each of the harbors; the allotment for Oak Orchard Harbor to be expended in repairs to the piers and, if investigation showed it necessary, to dredge the entrance channel.

The amount expended to June 30, 1903, was \$205,837.54. The cost of construction and maintenance can not be separated.

During the past year the timber superstructure was repaired and refilled with stone where needed. No dredging was done in the channel, as the commerce of the harbor did not demand it.

The maximum depth that could be carried June 30, 1903, over the shoalest part of the improvement was 9½ feet at low water, and the usual variation of level of water surface is 3 feet.

The commerce of Oak Orchard is insignificant, being mostly excursion and summer-resort business.

For more extended information and sketch see Annual Report of the Chief of Engineers for 1879, page 1727, and for 1897 page 3314 et seq.; also printed, with map, in House Document No. 281, Fifty-fourth Congress, second session.

The question of the desirability of continuing or modifying the project for improvement of Oak Orchard Harbor has been referred, by the Committee on Rivers and Harbors of the House of Representatives, to the Board of Engineers created in accordance with section 3 of the river and harbor act of June 13, 1902. The report of this Board will be submitted to Congress not later than December 7, 1903. In the meantime there is submitted an estimate of \$35,000 for maintenance.

July 1, 1902, balance unexpended	\$4,500.00
June 30, 1903, amount expended during fiscal year	1,262.93

July 1, 1903, balance unexpended	3,237.07
--	----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	64,000.00

(See Appendix T T 1.)

2. *Harbor at Olcott, N. Y.*—This harbor is at the mouth of Eighteen-mile Creek. In its original condition there was a depth of 3 feet on the bar.

The original project, adopted in 1867, provided for a channel 11 feet deep and 150 feet wide between parallel piers about 200 feet apart. The piers were built, east pier 850 feet and west pier 873 feet long, and the channel dredged 11 feet deep. In 1891 a new project was adopted calling for a depth of 13½ feet from the Main Street Bridge to deep water in the lake. The adopted plane of reference is low water of

Lake Ontario (zero of the Oswego gauge). The width of the channel of the project is 180 feet between the piers, narrowing to 98 feet at Main Street Bridge.

The piers are intact, but in need of extensive repairs, and the channel fills in rapidly and requires dredging annually to maintain the required depth.

The amount expended to June 30, 1903, was \$177,747.76. It is impracticable to separate the cost of construction and maintenance.

During the past fiscal year the most necessary repairs were made to both pier superstructures and a breach 90 feet long at the inner end of the west pier was temporarily closed with sheet piling. The channel was dredged to the full depth of 13½ feet at low water (zero of Oswego gauge) for a width of 140 feet between the piers and inside the piers about halfway to Main Street Bridge. The channel outside of the piers could not be dredged owing to lack of funds.

The maximum draft that could be carried June 30, 1903, over the shoalest part of the improvement was 10 feet at low water. The usual variation of level of water surface is 3 feet.

The commerce of Olcott is small, but a considerable excursion business is developing.

For more extended information and map see Annual Report of the Chief of Engineers for 1891, page 2893 et seq.

Report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$15,000. 00
June 30, 1903, amount expended during fiscal year	14,747. 76
July 1, 1903, balance unexpended	252. 24

Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	20,000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix T T 2.)

3. *Harbor at Charlotte, N. Y.*—This harbor is at the mouth of the Genesee River. In its original condition vessels could carry only 8 feet across the bar.

The original project of 1829 was to secure a channel 12 feet deep across the bar by constructing parallel piers to confine and direct the action of spring freshets. The present project of 1882 is to obtain a depth of 15 feet by extending the two piers a total of 3,250 feet and by dredging. (See Annual Report of the Chief of Engineers for 1881, p. 2457.) After the piers had been extended 1,444 feet the project was modified July 18, 1896, to preserve the depth by dredging without further extension of the piers for the present, and March 2, 1897, it was again modified to obtain and maintain not less than 16 feet and not more than 16½ feet at low water (zero of Oswego and Charlotte gauges), in a channel not more than 200 feet wide.

The river and harbor act of June 13, 1902, adopted a modified project to narrow the entrance channel, now 475 feet wide, to 200 feet, by means of 3,600 linear feet of brush mattress and stone laid lengthwise of the channel, at an estimated cost of \$15,000. This modification was so strenuously opposed by all parties engaged in the commerce of the

harbor that the abandonment of the modified project and resumption of the previously approved project was authorized January 24, 1903. The \$15,000 was subsequently turned over to maintenance under act of June 13, 1902.

The amount expended to June 30, 1903, was \$540,309.56. It is impracticable to separate the cost of construction and maintenance.

During the fiscal year minor repairs were made to the superstructures of both piers and the channel dredged where necessary to make it 16 feet deep at low water, 150 feet wide between the piers, and 225 feet wide outside the piers.

Plans and preparations were also made for rebuilding about 400 linear feet of the badly decayed superstructure of the west pier with concrete by day labor. The necessary plant for this work had been purchased and actual work was about to begin at the close of the fiscal year.

June 30, 1903, the maximum draft that could be carried in the channel at low water was 15 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of the commerce at this port during the past ten years:

Year.	Tons.	Year.	Tons.
1893	347, 288	1898	483, 850
1894	400, 492	1899	447, 428
1895	369, 417	1900	399, 606
1896	444, 567	1901	549, 207
1897	385, 981	1902	567, 690

The work proposed for the ensuing fiscal year, to make the improvement available, is to make necessary repairs to piers and to dredge the channel.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2436.

A chart of Charlotte Harbor is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index number 118.

July 1, 1902, balance unexpended \$30, 024. 51

June 30, 1903, amount expended during fiscal year..... 8, 505. 67

July 1, 1903, balance unexpended 21, 518. 84

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903..... 60, 000. 00
 { Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix T T 3.)

4. *Harbor at Great Sodus Bay, New York.*—In its original condition the channel connecting this bay with Lake Ontario was wide and impracticable for vessels drawing over 8 feet.

The original project of 1829 was to narrow the entrance by constructing two converging breakwaters and deepen it to 12 feet by building two parallel piers about 450 feet apart connecting with the ends of the breakwater and by dredging. The present project of 1889 is to obtain a depth of 15 feet at low water by extending the two piers a total of 1,100 feet and by dredging. After the piers had been

extended 519 feet to their present lengths—west pier 1,580 feet, east pier 1,294 feet—the project was modified July 18, 1896, to restore and maintain the requisite depth of 15 feet by dredging, without further extension of the piers for the present.

The amount expended to June 30, 1903, was \$491,806.38, of which \$83,554.58 was for maintenance.

During the fiscal year minor repairs were made to the decks of both piers and the channel dredged where necessary to make it 150 feet wide and 15 feet deep at extreme low water ($\frac{1}{10}$ feet below zero of Oswego gauge) outside the piers, and not less than 14 feet deep at extreme low water between the piers.

The minimum depth June 30, 1903, is 13 feet below low water in a channel width of 150 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for the past ten years:

Year.	Tons.	Year.	Tons.
1893	14, 277	1898	79, 709
1894	77, 471	1899	78, 885
1895	43, 566	1900	84, 379
1896	36, 361	1901	57, 730
1897	36, 361	1902	26, 726

Work proposed for the ensuing fiscal year necessary to make the improvement available is to dredge and make necessary repairs to the piers.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2441 et seq.

A chart of Great Sodus Bay is issued in the series of charts of the survey of the Northern and Northwestern lakes, index No. 129.

July 1, 1902, balance unexpended \$5, 060. 20

June 30, 1903, amount expended during fiscal year 2, 218. 78

July 1, 1903, balance unexpended 2, 841. 42

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903..... 5, 000. 00
 { Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix T T 4.)

5. *Harbor at Little Sodus Bay, New York.*—In its original condition the channel connecting this bay with Lake Ontario was about 150 feet wide and 18 inches deep.

The original project of 1854 was to deepen the channel by building two parallel piers 250 feet apart across the bar to the 15-foot curve in the lake and to connect them with the shore by breakwaters. In 1867 this project was modified to provide for dredging to the depth of 12 feet. The present project of 1882 is to obtain a depth of 15 feet at low water (zero of Oswego gauge) by extending the piers to the 15-foot curve in the lake and by dredging. After the piers had been extended 835 feet to their present lengths—west pier 1,747 feet, east pier 1,510 feet—the project was modified June 29, 1898, to restore and maintain the requisite depth of 15 feet by dredging, without further extension of the piers for the present, and this was modified by the river and harbor act of June 13, 1902, to extend the east pier 300 feet.

The amount expended to June 30, 1903, was \$341,664.67, of which \$61,216.41 was applied to maintenance of improvement.

During the past fiscal year minor repairs were made to the decks of both piers and the channel dredged where necessary to make it 100 feet wide and 15 feet deep at extreme low water ($\frac{1}{2}$ feet below zero of Oswego gauge) between deep water in the lake and in the bay. The extension of the east pier 300 feet was in progress under contract to be completed December 1, 1903.

The minimum depth over the shoalest part of the locality under improvement, June 30, 1903, was 13 $\frac{1}{2}$ feet at low water in a channel width of 100 feet, and the usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for ten years:

Year.	Tons.	Year.	Tons.
1893	66,345	1898	50,339
1894	63,595	1899	81,969
1895	63,708	1900	59,511
1896	65,418	1901	135,118
1897	68,888	1902	52,543

Work proposed for the ensuing fiscal year, necessary to make the improvement available, consists in maintenance of channel and piers.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2443 et seq.

A chart of Little Sodus Bay, now in preparation, will be published in the series of charts of the survey of the Northern and Northwestern Lakes.

July 1, 1902, balance unexpended	\$25,173.20
June 30, 1903, amount expended during fiscal year	3,395.10

July 1, 1903, balance unexpended	21,778.10
--	-----------

July 1, 1903, amount covered by uncompleted contracts	21,016.00
---	-----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	35,000.00

(See Appendix T T 5.)

6. *Harbor at Oswego, N. Y.*—This harbor comprises the lower part of the Oswego River and an outer cove. In its original condition the inner part was navigable by vessels of light draft only, and the outer part had no protection against the seas.

The original project of 1827 (completed in 1829) was to build across the cove a breakwater of timber cribs filled with stone. Between 1830 and 1838 a superstructure of masonry was built on 500 feet of the breakwater. Between 1866 and 1869, \$41,000 was expended in dredging the harbor to the depth of 12 feet at extreme low water. Between 1868 and 1870 the light-house pier was extended north 437 feet. In 1881 an outer breakwater was completed, having a lake face 4,870 feet long, a westerly shore return 916 feet long, and an easterly return 246 feet long. In 1881 a project was adopted to build an east breakwater, 248 feet of which was constructed in 1881 and removed in 1889. In

1885 and 1889 two spurs to the outer breakwater, 100 and 150 feet long, respectively, were completed. In 1893 (sundry civil act of March 3), the excavation of rock in the river was added to the project.

The present project of 1896, as subsequently modified, is: First, to build an east breakwater 1,435 feet long, at an estimated cost of \$197,000 (acts of March 3, 1895, and June 3, 1896); second, to narrow the breach made in the outer breakwater in 1884 from 175 to about 75 feet, at an estimated cost of \$18,500 (June 20, 1896); third, to carry the rock excavation in the Oswego River farther upstream (March 3, 1897); fourth, to remove part of the island between Schuyler and Van Buren streets to a depth of 15 feet; also to excavate rock and dredge to a small extent between the island and the west bank, at an estimated cost of \$12,000 (March 6, 1897, and act of March 3, 1899).

The plane of reference is extreme low water, seven-tenths foot below the zero of Oswego gauge.

There are 5,907 feet of outer breakwater and 1,993 feet of inner breakwater, forming an outer harbor containing 140 acres and an inner harbor containing 9.35 acres (including the Oswego River). The areas having a controlling depth of 14.5 feet at low water are 40 acres in the outer harbor and 4½ acres in the inner harbor.

The outer breakwater is in bad condition, and the river and harbor act of June 13, 1902, provides for a preliminary examination and survey, to determine what repairs are necessary and advisable. Report thereon will be submitted to Congress in December, 1903.

The amount expended to June 30, 1903, was \$1,983,481.75. It is impracticable to separate the cost of construction and maintenance.

During the fiscal year ending June 30, 1903, the outer breakwater was repaired as much as possible with the funds available. The inner breakwater was repaired where absolutely necessary, and the removal of rock in the Oswego River and of shoals in the outer harbor and entrance channel was carried on as funds would permit in connection with the breakwater repairs.

June 30, 1903, the minimum depth at extreme low water over the shoalest part of the locality under improvement was 14 feet.

The usual variation of level of water surface is 3 feet.

The following is a statement of the commerce of this harbor for the past ten years:

Year.	Tons.	Year.	Tons.
1893	947, 688	1898	615, 508
1894	829, 469	1899	716, 753
1895	749, 575	1900	575, 180
1896	783, 972	1901	565, 062
1897	706, 805	1902	334, 009

Work proposed for the ensuing fiscal year necessary to make the improvement available consists in rock excavation in Oswego River and dredging on shoals as may be required in the outer harbor and entrance channel.

Repairs on the outer breakwater will be continued under the present plan of securing the crib walls of the substructure and keeping the decks in repair to the extent practicable with the funds available. It is hoped that these repairs will lessen the liability to serious wreckage

by severe storms pending the adoption of more efficient plans for repairs.

For more extended information and map see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

A chart of Oswego Harbor is published in the series of charts of the survey of the Northern and Northwestern Lakes, index number 137.

July 1, 1902, balance unexpended.....	\$52,105.90
June 30, 1903, amount expended during fiscal year.....	11,974.78
July 1, 1903, balance unexpended.....	<u>40,131.12</u>

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....		50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

(See Appendix T T 6.)

7. *Harbor of Cape Vincent, N. Y.*—This harbor is an open roadstead on the St. Lawrence River, $2\frac{1}{4}$ miles from Lake Ontario, and is a convenient location for vessels to lie during storms at night and in thick weather.

The original project of 1896 was to build a breakwater parallel to and 600 feet from the railroad wharf, 1,600 feet long, at an estimated cost of \$320,000. On May 13, 1899, this project was modified to build a breakwater parallel to and 500 feet from the railroad wharf, 1,550 feet long, of which length 150 feet or so much thereof as required was to be a shore return at upper end at an estimated cost of \$200,000. Four hundred and ten feet of this breakwater, of which 50 feet was shore return, was built in 1900, and 300 feet is being built under contract to be completed December 1, 1903.

The amount expended to June 30, 1903, was \$49,622.15, all for construction.

The maximum draft that could be carried over the locality under improvement at mean low water June 30, 1903, was 19 feet, and the usual variation of level of water surface is 3 feet.

The commerce of Cape Vincent is not large. This improvement is intended to make a harbor of refuge for all craft plying between Lake Ontario and the St. Lawrence River.

Work proposed for the fiscal year ending June 30, 1905, necessary to make the improvement available is to continue the extension of the breakwater as far as the funds that may be appropriated will permit.

For more extended information and map see Annual Report of the Chief of Engineers for 1897, page 3286 et seq.

July 1, 1902, balance unexpended.....	\$49,036.01
June 30, 1903, amount expended during fiscal year.....	658.16
July 1, 1903, balance unexpended.....	<u>48,377.85</u>
July 1, 1903, amount covered by uncompleted contracts.....	<u>43,065.40</u>

{ Amount (estimated) required for completion of existing project.....		102,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....		62,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.		

(See Appendix T T 7.)

8. *Shoals in the St. Lawrence River, between Ogdensburg and the foot of Lake Ontario.*—In its original condition the channel of the St. Lawrence River, from Sister Island light down to the head of Brockville Narrows, was obstructed by 12 ledges, on which the depth was $9\frac{1}{2}$ feet to 16 feet at low water.

The original project, act of September 19, 1890, was to remove to 18 feet below the zero of the Ogdensburg gauge ledges between Sister Island and Crossover lights, at an estimated cost of \$43,305. In 1893, owing to the discovery of several outlying spurs, the estimated cost was increased to \$54,772. By the act of June 3, 1896, the project was extended to embrace ledges in the St. Lawrence River, between Ogdensburg and the foot of Lake Ontario.

April 13, 1897, the removal of the obstructions to a depth of 1.4 feet greater, i. e., to 18 feet below the zero of the Oswego gauge, was included in the project, thereby increasing the total estimated cost to \$108,000.

The amount expended to June 30, 1903, was \$67,857.45, all for works of improvement. No work was done during the past fiscal year owing to lack of funds.

There were 12 dangerous shoals and rock ledges in or near the track of vessels, of which 9 (all the rock ledges in United States waters) have been removed to 18 feet below the zero of the Oswego gauge.

There still remains to be removed three or more rock ledges and shoals in Canadian waters, which are included in the project.

The maximum draft that could be carried over the locality under improvement at mean low water June 30, 1903, was 16 feet, and the usual variation of level of water surface is 3 feet.

All the commerce of the St. Lawrence River is benefited by this improvement.

For more extended information see Annual Report of the Chief of Engineers for 1901, page 3373 et seq.

Charts showing the locality are issued in the series of charts of the survey of the Northern and Northwestern Lakes, index numbers 117, 119, and 46.

July 1, 1902, balance unexpended	\$418.06
June 30, 1903, amount expended during fiscal year	275.51
July 1, 1903, balance unexpended	142.55

{ Amount (estimated) required for completion of existing project	40,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	30,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix T T 8.)

9. *Harbor at Ogdensburg, N. Y.*—In its original condition the low-water depth in this harbor was 9 feet in the channel leading to the Oswegatchie River, 10 to 12 feet in the two lower entrance channels, and 6 to 12 feet along the city front.

The original project of 1868 was to dredge to the depth of 12 feet and to build, if necessary, 5,500 linear feet of piers, at an estimated cost of \$100,000. The piers were never built. The project of 1882 provided for dredging the channel across the shoal to the mouth of the Oswegatchie to 16 feet and all other channels to 15 feet at extreme

low water, at an estimated cost of \$76,000. The present project (see Annual Report of the Chief of Engineers for 1890, p. 2872) provided for dredging all the channels to a depth of 16.5 feet below the zero of the Ogdensburg gauge (15 feet below the zero of the Oswego gauge), at an estimated cost of \$158,950. The project was modified February 27, 1897, to deepen the two lower entrance channels to 16 feet below the zero of the Oswego gauge, and by act of March 3, 1899, further modified to dredge 900 feet of the channel along the front of Ogdensburg above Franklin street to but 14 feet below the same zero; elsewhere the projected depths to remain 15 feet.

The amount expended to June 30, 1903, was \$311,785.18, of which \$40,065.97 was applied to maintenance of improvement.

The maximum draft that could be carried over the improvement at mean low water June 30, 1903, was as follows: In the lower entrance channels, 15 feet; in the channel along the city front, 12 feet; elsewhere, 15 feet. The usual variation of level of water surface is 3 feet.

The following is a statement of commerce at this port for the past ten years:

Year.	Tons.	Year.	Tons.
1893	908,048	1898	645,201
1894	736,064	1899	670,363
1895	693,825	1900	646,248
1896	886,438	1901 (incomplete)	439,148
1897	866,035	1902 (incomplete)	837,025

Work proposed for the ensuing fiscal year necessary to make improvement available consists in dredging channels wherever necessary.

For more extended information and map, see Annual Report of the Chief of Engineers for 1881, page 2451 et seq.

A chart of Ogdensburg Harbor, now in preparation, will be published in the series of charts of the survey of the Northern and Northwestern Lakes.

July 1, 1902, balance unexpended	\$20,042.29
June 30, 1903, amount expended during fiscal year	14,471.91

July 1, 1903, balance unexpended	5,570.38
--	----------

July 1, 1903, amount covered by uncompleted contracts	4,195.25
---	----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	15,000.00

(See Appendix T T 9.)

10. *St. Lawrence River at the head of Long Sault Island, New York.*—This is a new work and consists of dredging a channel 1,700 feet long across a shoal at the head of Long Sault Island, in the St. Lawrence River, to be 150 feet wide and 18 feet deep.

The funds are available but no work has been done, and none is to be done because the St. Lawrence River Power Company, successor to the Saint Lawrence Power Company, declined to comply with the conditions of the act of June 13, 1902, appropriating funds for the work, and having obtained permission from the Secretary of War,

March 20, 1903, to perform the proposed work itself, under section 1 of the river and harbor act of June 13, 1902, has begun the work.

The shoalest locality under improvement is 5 feet, and the usual variation of level of water surface is 2 feet. The commerce to be benefited is wholly prospective.

A chart of the locality is issued in the series of charts of the survey of the Northern and Northwestern Lakes, index number 42.

July 1, 1902, balance unexpended	\$48,000. 00
July 1, 1903, balance unexpended	48,000. 00

(See Appendix T T 10.)

11. Removing sunken vessels or craft obstructing or endangering navigation.—The sum of \$8.02 was expended in the examination of a reported obstruction lying off Braddock Point light station, Lake Ontario. Being so far inshore as not to menace navigation its removal was not deemed necessary.

(See Appendix T T 11.)

PACIFIC COAST.

IMPROVEMENT OF HARBORS IN CALIFORNIA SOUTH OF SAN FRANCISCO.

This district was in the charge of Capt. Edgar Jadwin, Corps of Engineers, until June 17, 1903, and of Maj. J. H. Willard, Corps of Engineers, since that date. Division Engineer, Col. D. P. Heap, Corps of Engineers.

1. San Diego Harbor, California.—San Diego Harbor is just north of the national boundary of Mexico and 482 nautical miles south of San Francisco.

The river and harbor act approved March 3, 1875, appropriated \$80,000 for the construction of a dike across the mouth of the San Diego River, causing it to empty into False Bay, and thus preventing San Diego Harbor from being injured by the deposit of material brought down during flood stages. This work was completed in 1876, at a cost of \$79,798.72, which, with the cost of repairs made up to the time of adoption of the present project, brought the total of expenditures to \$81,918.45.

The present project for the improvement of the harbor, approved December 8 and 30, 1890, has for its object the construction of a jetty on Zuniga shoal, at the entrance to the harbor; the maintaining of a channel 24 feet deep at mean low tide and 500 feet wide through the middle ground, and the repairs of the dike. The jetty was to be about 7,500 feet long, extending from Coronado Island out on Zuniga shoal, with a view to gaining 26 feet at mean low tide on the outer bar, where the survey of 1887 showed a depth of 21 feet.

The original estimated cost of this improvement was \$394,400, but as work on the inner half of the jetty progressed under the different contracts it became evident that this sum would be inadequate. Therefore, under date of June 20, 1900, the local officer was authorized to change this estimated cost to \$542,850.

This project was modified July 29, 1902, so as to include dredging on the outer bar to a depth of 26 feet at low water and a width of channel of about 500 feet.

The amount expended on the present project up to the close of the fiscal year ending June 30, 1903, is \$277,655.47.

The jetty has been completed for a distance of 4,595 feet, and the foundation course extended 430 feet farther. No work has been done since October, 1900.

No material results in the way of increased depth or width of channel over the outer bar have been obtained during the past year, the least channel depth being approximately 22 feet; the average height of all high waters above the plane of reference is 4.8 feet.

In 1896 a contract for further repairs on the restraining dike was made, the cost of the work amounting to \$4,913.58.

The river and harbor act of June 13, 1902, appropriated \$75,000 for continuing this improvement, with the proviso that a contract or contracts might be entered into by the Secretary of War for such materials and work as might be necessary to complete the approved project at a cost not to exceed in the aggregate \$192,850, in addition to the \$75,000 mentioned above. The sundry civil act of March 3, 1903, appropriated the \$192,850 for the completion of the project, and contracts for doing the work have been awarded.

The commerce of this harbor was 105,100 tons for the year 1902, this being a decrease of 13 per cent from that of the previous year. The effect on commerce of this work of improvement will be to admit of the entrance of deeper-draft vessels and to make their passage safer by straightening the channel.

July 1, 1902, balance unexpended	\$76,717.80
Amount appropriated by sundry civil act approved March 3, 1903	192,850.00
	269,567.80
June 30, 1903, amount expended during fiscal year	3,791.72
July 1, 1903, balance unexpended	265,776.08
July 1, 1903, outstanding liabilities	42.40
July 1, 1903, balance available	265,733.68
July 1, 1903, amount covered by uncompleted contracts	235,000.00
(See Appendix V V 1.)	

2. *Deep-water harbor at San Pedro Bay, California.*—The river and harbor act of June 3, 1896, provided for the appointment of a Board to determine upon the location of a deep-water harbor for commerce and for refuge in Santa Monica Bay, California, or at San Pedro, in the same State, the decision of a majority of the Board as to location to be final. The Board was to make plans, specifications, and estimates for said improvement. After the Board had rendered its decision and submitted its report the Secretary of War was empowered to make contracts for the completion of the selected harbor in accordance with the project of the Board, at a cost not exceeding in the aggregate \$2,900,000.

In accordance with the provisions of this act a Board was appointed, which submitted its report March 1, 1897, deciding in favor of San Pedro Bay. The report of the Board is printed in Senate Document No. 18, Fifty-fifth Congress, first session.

On August 12, 1898, a contract was entered into with Messrs. Heldmaier & Neu, of Chicago, Ill., for the construction of the entire breakwater, the price bid by them being \$1,303,198.54. The contractors

were to commence work on or before November 12, 1898, and they were so to prosecute it as to earn each year the money appropriated by Congress.

This contract was annulled on March 19, 1900, the contractors having failed to attain the rate of progress required by the specifications.

On June 7, 1900, a contract for continuing and completing the construction of the breakwater was entered into with the California Construction Company, of San Francisco, Cal., and the same was approved by the Chief of Engineers on June 27, 1900; time of commencement of work to be August 4, 1900. The estimated cost of this work, using the quantities on which bids were canvassed and the prices bid for stone and concrete, and allowing 10 per cent for engineering expenses and contingencies, is \$2,613,100.66, exclusive of expenditures prior to June 30, 1900.

Under this contract 1,118,783 tons of stone has been delivered and placed in the substructure of the breakwater. This substructure is practically completed for a distance of 5,715 feet from its westerly extremity, and has been more or less built up for a distance of 350 feet farther.

The superstructure was begun at a distance of 632 feet from the westerly end of the breakwater and extended eastward 678 feet on the ocean side and 735 feet on the harbor side, 21,242 tons of stone having been placed in the work.

The amount expended on this work to June 30, 1903, is \$959,436.92.

The commerce of San Pedro Harbor, heretofore simply an anchorage ground in an open roadstead, is so intimately connected with that of Wilmington Harbor that reference is made thereto for statistics on same. The effect on commerce of this work will be to afford a place of refuge, easy of access and secure from storms, for coastwise and deep-draft vessels, and a protected harbor of about 1 square mile in area for the commerce of the latter class of vessels. Vessels while waiting for a favorable tide in order to enter the inner harbor of San Pedro now anchor in the lee of the partly built breakwater.

July 1, 1902, balance unexpended	\$533, 546. 61
Proceeds of sale of condemned engineer property	. 05
Amount appropriated by sundry civil act approved March 3, 1903	500, 000. 00
June 30, 1903, amount expended during fiscal year	1, 033, 546. 66
	421, 454. 29
July 1, 1903, balance unexpended	612, 092. 37
July 1, 1903, outstanding liabilities	40, 573. 75
July 1, 1903, balance available	571, 518. 62
July 1, 1903, amount covered by uncompleted contracts	1, 664, 627. 42
{ Amount (estimated) required for completion of existing project	1, 093, 108. 85
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U U 2.)

3. *Wilmington Harbor, California.*—Wilmington is situated at the head of a small estuary which has its outlet in the bay of San Pedro, and is 393 nautical miles to the southward of San Francisco.

Previous to the commencement of the improvement, in 1871, there was a depth of less than 2 feet of water at low tide at the entrance.

The original project, approved July 1, 1871, contemplated gaining a depth of 10 feet at mean low tide. This depth was obtained in 1881, at a cost of \$555,000, when a further project to increase depth of channel from 10 to 15 feet at mean low tide by dredging a reef between the jetties, raising existing works, and extending the jetties to 18 feet of water in San Pedro Bay was submitted. This project was completed in 1893, at a cost of \$399,497.68.

The river and harbor act of June 3, 1896, appropriated \$50,000 for improving the harbor in accordance with a project submitted in 1894 for a channel depth of 18 feet at mean low tide, at an estimated cost of \$392,725. Owing to certain provisos, however, this money was not available without further action by Congress.

The river and harbor act of June 13, 1902, provided for the further improvement of this harbor by appropriating \$250,000 for carrying forward this work in accordance with the plan for its partial improvement as submitted in House Document No. 357, Fifty-sixth Congress, first session (see also Annual Report of the Chief of Engineers for 1900, pp. 4194-4211), including the construction or purchase of a suitable dredge; the unexpended \$50,000 appropriated under act of June 3, 1896, was also made available for this work.

This work, including dredge, is estimated to cost \$550,000. Work on this project was begun October 17, 1902. A weak portion of the east jetty was reenforced with stone, and dredging the harbor under contract was begun.

Up to the close of the fiscal year ending June 30, 1903, the amount expended on this improvement was \$978,418.14.

By this expenditure the available channel depth has been increased from 2 feet to approximately 15.6 feet at mean low tide, which is the least channel depth over the bar at the entrance at the close of the fiscal year; the average rise of the tide above this plane of reference is 5.1 feet.

The commerce of this harbor, which is principally coastwise, was 595,148 tons for the year 1902, an increase of 22 per cent over the preceding year.

July 1, 1902, balance unexpended	\$300,502.32
June 30, 1903, amount expended during fiscal year	23,920.46
July 1, 1903, balance unexpended	276,581.86
July 1, 1903, outstanding liabilities	9,676.08
July 1, 1903, balance available	266,905.78
July 1, 1903, amount covered by uncompleted contracts	76,323.29
{ Amount (estimated) required for completion of existing project	249,497.68
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U U 3.)

4. *San Luis Obispo Harbor, California.*—San Luis Obispo Harbor is 9 miles to the southward and westward of the town of San Luis Obispo, 216 nautical miles from San Francisco.

It is a bight of the coast about 18 miles long between Point San Luis

on the north and Point Sal on the south. The upper end, where Port Harford is situated, has a wharf and is the part used for commercial purposes. Whaler reef, extending nearly half a mile to the southward and eastward of Point San Luis, forms more or less of a natural breakwater, but during the winter season it is exposed to the heavy swell caused by southerly gales.

The original project, approved September 22, 1888, was to construct a breakwater of rough stone on Whaler reef, extending from Point San Luis to Whaler Island, and thence to a point where the outer reef rises above high water. Its length when completed, including the island, was to be nearly 2,000 feet, and it was to be brought up to the plane of mean low water, at an estimated cost of \$284,898. This project was subsequently modified, January 17, 1893, so as to raise the structure to a height of 6 feet above high water, with a thickness on top of 20 feet and such side slopes as may be assumed under the action of the sea. The estimated cost was increased to \$568,660.

The storms of the last three winters have knocked down a portion of the outer end of the breakwater. More or less stone has also been knocked off in other places by the heavy seas breaking over the structure.

A contract for the expenditure of the \$50,000 appropriated by river and harbor act of June 13, 1902, has been made, at \$1.86 per short ton of stone delivered and placed in the breakwater. Work under this contract was begun April 25, 1903, but owing to the continued rough weather only 4,711 tons of stone has been delivered.

The amount expended on this work up to the close of the fiscal year ending June 30, 1903, is \$231,312.48.

The completed breakwater has been built from Point San Luis and extended to a distance of 700 feet from Whaler Island, and a section, more or less completed, has been built 500 feet farther. The result has been to give increased security to vessels at the landing and anchorage against heavy swells.

The commerce of this harbor was 55,707 tons for the year 1902, an increase of 36 per cent over the preceding year.

July 1, 1902, balance unexpended.....	\$51,200.94
Proceeds of sale of condemned engineer property.....	.95
June 30, 1903, amount expended during fiscal year.....	51,201.89
July 1, 1903, balance unexpended.....	48,688.47
July 1, 1903, outstanding liabilities.....	6,710.98
July 1, 1903, balance available.....	41,977.49
July 1, 1903, amount covered by uncompleted contracts.....	39,503.12
{ Amount (estimated) required for completion of existing project.....	288,660.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903.....	65,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix U U 4.)

IMPROVEMENT OF RIVERS AND HARBORS IN CALIFORNIA TRIBUTARY TO AND NORTH OF SAN FRANCISCO BAY, AND OF PEARL HARBOR, HAWAII.

This district was in the charge of Lieut. Col. W. H. Heuer, Corps of Engineers.

1. *Harbor at Alviso, Cal.*—Before improvement Alviso Slough was a small tidal estuary about $3\frac{1}{2}$ miles in length, 60 to 800 feet in width, and from 3 to 7 feet deep at low water. The tidal range varied from 7 to 11 feet.

Preliminary examinations were ordered by Congress, and were made in 1890 and 1892. The reports were unfavorable, and a survey and estimate was required and made in 1896. This provided for a project to obtain by dredging a channel 7 feet deep at low water, 60 to 80 feet wide, and a turning basin in front of Alviso. The whole was estimated to cost \$48,000.

By act of March 3, 1899, Congress appropriated \$48,000 to carry out the project. Contract was made in 1899, but the contractor failed, and the surety company paid the amount of the bond, which was \$10,000. The work was relet in May, 1900, and was fully completed in June, 1901, as required by the project, at a cost of \$27,543.47, which left an unexpended balance of the appropriation amounting to \$20,456.53.

By act of June 13, 1902, Congress made this unexpended balance available for extension and further improvement of the channel heretofore made. Resurvey made shortly thereafter showed a refilling in the channel during the preceding fourteen months of upward of 100,000 cubic yards of material, which was about 60 per cent of the amount previously dredged, and which was traced as coming from the Guadalupe River, which empties into the slough opposite the village of Alviso. It was found useless to dig deeper than was done in 1901, and as the dredged channel at and near Alviso extended from bank to bank, it could not be made wider there, and below Alviso the channel was wide and deep enough for all purposes of commerce and navigation.

It was also estimated that it would cost about \$10,000 annually to maintain the channel, without commensurate benefits. In view of these facts, and with the approval of the Secretary of War, no work for the extension and further improvement of the channel has been undertaken during the past fiscal year.

As commerce and navigation have not increased since the completion of the work, and as the existing channel is believed to be ample for present commerce, the engineer officer in charge of the work considers Alviso Slough and harbor at present unworthy of further improvement.

The total amount expended on the work to June 30, 1903, was \$27,687.72. The balance available is \$20,312.28.

There have been no material advantages derived from the improvement thus far made. The maximum draft that can be carried to Alviso at low tide is probably 4 feet; the range of tide is from 7 to 11 feet. Alviso is the head of navigation of Alviso Slough.

July 1, 1902, balance unexpended	\$20,456.53
June 30, 1903, amount expended during fiscal year	144.25

July 1, 1903, balance unexpended	20,312.28
--	-----------

(See Appendix V V 1.)

2. *Redwood Creek, California.*—Before improvement there were shoals in Redwood Creek that were bare at low tide; which permitted vessels to use it only during medium and high stages of tide.

Project for its improvement was made in 1882, recommending the dredging of channels aggregating about 6,000 feet in length, 50 to 60 feet in width, and to have a depth of $2\frac{1}{2}$ to 3 feet at low water wherever necessary in the creek, at an estimated cost of \$15,400. From 1884 to 1888, inclusive, appropriations aggregating said amount were made, and the project was completed in August, 1889, as contemplated. The channels not being self-maintaining, an additional appropriation of \$8,000 was made in 1890, the channels were redredged and the work completed in August, 1892. The total amount expended on the project up to June 30, 1895, was \$23,400.

The existing project was submitted in consequence of an examination of the creek ordered by act of Congress of 1896. The project provides for cutting a channel, to have about 5 feet depth at low water, through a middle ground bare at low water; dredging in front of the city wharf near Redwood City; building a sheet-pile dam across a navigable slough, and constructing a dike of timber and brush at the foot of the channel to be dredged through the middle ground. The work was estimated to cost \$8,400.

By act of June 13, 1902, Congress appropriated \$8,400 for completing the improvement in accordance with the above project.

Project for the expenditure of the appropriation was approved July 17, 1902. Thereafter, while making a survey of the locality to be improved, it was found that the area through which the channel was to be dredged was held in private or corporate ownership. The owners gave right of way free of expense to the Government to dredge a channel as contemplated through this ground. It was also found that if the other channel was closed by a dam, as projected, it would interfere with the free tidal movement necessary to maintain the larger channel contemplated to be cut through the middle ground.

Contract for the dredging was made, and, on June 30, 1903, the cut through the middle ground was completed to a full width of 100 feet and a least depth of 7 feet at low water, though the contractor was only required to dredge, and was only paid for, a channel 100 feet in width and 5 feet in depth at low water. The dredging near the city wharf is also in progress. The whole work will probably be completed early in July, 1903.

The total amount expended on this work to June 30, 1903, was \$1,545.56.

The work done furnishes a fine channel 100 feet wide, and of a low-water depth of 7 feet to within 100 feet or less of the city wharf at Redwood City. The usual rise and fall of the tide at this locality is approximately 5 feet. The head of navigation on the creek is a few hundred yards above the city wharf.

It is believed that the improvement which is so nearly completed is sufficient for all the requirements of commerce and navigation for several years. As there is no tidal basin of any consequence above the wharf, the areas dredged will gradually refill, and occasional redredging at several years' interval may be necessary.

Examinations or surveys were made in 1882, 1890, 1893, and 1897. The reports are printed in the Annual Reports of the Chief of Engineers for 1884, page 2204; for 1891, page 2966; for 1893, page 3225, and for 1897, page 3349.

July 1, 1902, balance unexpended	\$8,400.00
June 30, 1903, amount expended during fiscal year	1,545.56
July 1, 1903, balance unexpended	6,854.44
July 1, 1903, amount covered by uncompleted contracts	5,075.74

(See Appendix V V 2.)

3. *Harbor at San Francisco, Cal.*—The improvement contemplated the removal of the two Shag rocks, Arch rock, and Blossom rock, from San Francisco Harbor, to a depth of 30 feet below mean low water.

A description of the rocks, with estimate of cost, is printed in the Annual Report of the Chief of Engineers for 1898, page 2923.

Up to June 30, 1903, there has been expended for the removal of the rocks referred to the sum of \$267,769.99. The estimated cost of the removal of the four rocks was \$731,220.

Congress, by acts of March 3, 1899, June 6, 1900, and March 3, 1903, appropriated an aggregate of \$320,000 for the removal of said rocks. Contracts were made for the complete removal of the rocks to the depth contemplated in the project for \$298,642. Arch rock and the two Shag rocks have been removed, and work on Blossom rock is now in progress.

On June 30, 1903, there was a least depth at low water of 30 feet over Arch rock and each of the two Shag rocks. The mean rise and fall of the tide is about 4.1 feet. The navigation interests have been largely benefited by the removal of these rocks. The money available is sufficient to complete the improvement, and further appropriations will not be required.

Full details of the method of removal of the rocks are printed in the Annual Reports of the Chief of Engineers for 1900 and 1901.

July 1, 1902, balance unexpended	\$108,238.70
Amount appropriated by sundry civil act approved March 3, 1903.....	50,000.00
June 30, 1903, amount expended during fiscal year.....	158,238.70
July 1, 1903, balance unexpended	106,008.69
July 1, 1903, balance unexpended	52,230.01
July 1, 1903, amount covered by uncompleted contracts.....	45,142.00

(See Appendix V V 3.)

4. *Oakland Harbor, California.*—In its original condition before improvement the depth of the entrance to San Leandro estuary, which is now Oakland Harbor, was 2 feet at low tide.

Project for improvement was submitted and approved February 15, 1874. Its object was—

First. A midtide training wall about 2 miles in length, extending from the shore westward into San Francisco Bay.

Second. A connection by a canal (tidal canal) 2½ miles in length with San Leandro Bay.

Third. A dam at the entrance to San Leandro Bay.

Fourth. Draining basin and channel, the latter to have a depth of 20 feet at low water.

Two modifications were adopted later, viz, one in 1875 to increase the width of the tidal canal to 400 feet, another in 1878 to raise the training walls to full tide height.

On June 6, 1900, in the emergency river and harbor act, provision was made for preliminary examination and survey of "Oakland Harbor, with a view to the improvement of said harbor to meet the needs of present and prospective commerce from the western end of the tidal canal to deep water in San Francisco Bay, including the excavation of a tidal basin."

The examination and survey were made and estimates for three separate projects were submitted through the Chief of Engineers, U. S. Army, which are printed in House Document No. 262, Fifty-sixth Congress, second session, and in the Annual Report of the Chief of Engineers for 1901, page 3434 and following.

By act of Congress of June 13, 1902, Congress appropriated \$100,000 and authorized contracts for \$150,000 additional, in accordance with report submitted in above document, but failed to specify which of the three projects above referred to was to be adopted; hence this matter is yet in abeyance. Contract was made to the extent of the money available for work of dredging, which was common to all three of the above projects.

The amount expended on the old projects (that is, prior to that submitted in House Document No. 262, Fifty-sixth Congress, second session) up to June 30, 1903, aggregates \$2,424,289, and on the new project to June 30, 1903, is \$7,366.72, making a total of \$2,431,655.72, leaving an available balance for continuance of work of \$249,944.28, of which upward of \$219,000 is covered by existing contracts, and which is enough to complete the projects as far as authorized at present by Congress.

The result is a channel 20 feet deep at low tide, fully 300 feet wide, and part of the way 400 feet wide, from San Francisco Bay to Webster Street Bridge; thence a channel 200 feet wide and fully 6 feet in depth around the north side of the tidal basin to the tidal canal; thence a channel 300 feet bottom width and nearly 400 feet top width, 8 feet deep at low water, through the tidal canal into shallow water of San Leandro Bay, and the construction of three steel bridges across the tidal canal, as also a new channel for Sausal Creek, to divert its waters and deposits from the tidal canal.

Work on the tidal canal was completed on March 31, 1903.

Since work was started commerce has increased immensely. Vessels drawing 19 feet can reach Webster Street Bridge at ordinary low water. The tidal range is from 4 to 5 feet.

July 1, 1902, balance unexpended	\$225, 919. 65
Amount appropriated by sundry civil act approved March 3, 1903.....	131, 000. 00
	356, 919. 65
June 30, 1903, amount expended during fiscal year.....	106, 975. 37
July 1, 1903, balance unexpended.....	249, 944. 28
July 1, 1903, amount covered by uncompleted contracts	219, 303. 00
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance unexpended July 1, 1903.....	19, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

(See Appendix V V 4.)

5. *San Pablo Bay, California*.—An examination of this bay was ordered by Congress by act of March 3, 1899. The report of the

examination was printed in House Document No. 89, Fifty-sixth Congress, first session.

The commerce passing over the bay was believed to exceed 2,000,000 tons per year. The least depth of water over the shoals at low water was 19 feet. The estimated cost of the improvement to obtain a channel 300 feet wide, a little more than 5 miles in length, and to have a depth of 30 feet at mean lower low water, was \$381,000, with an estimated annual cost for maintenance of about \$16,000. With an improved channel the largest vessels could get to Mare Island Navy-Yard.

The above project was adopted, and Congress, by act of June 13, 1902, appropriated \$100,000, and authorized a continuing contract for the completion of the work to the limit of \$381,000.

Contract for removing the shoal by dredging was made at the rate of 11.44 cents per cubic yard, place measurement. The cost of removal at this rate will be \$311,282.40.

The amount expended on the work to June 30, 1903, is \$2,120.16.

The contract required the removal of an average of at least 100,000 cubic yards dredged material per month. In four months the contractor has removed an aggregate of only 97,269 cubic yards, and hence no payments have been or can be made him until the requirements of the contract shall be complied with.

One cut 2,000 feet long, 100 to 140 feet in width, and to a depth of 30 feet below low water, has been made; and another cut about 2,500 feet long and 60 feet wide, but not down to grade plane, has also been made. The work thus far done has been of no benefit to commerce or navigation, as only 19 feet at low water can be carried over the shoal at the present time. The mean tidal range at the locality is about 4½ feet.

It has been estimated that the annual commerce passing over the bay exceeds 2,000,000 tons, and when improvement is completed the largest battle ships can get to Mare Island Navy-Yard.

It is estimated that \$81,000, in addition to what has been appropriated, will be required for the fiscal year ending June 30, 1905.

July 1, 1902, balance unexpended.....	\$100,000.00
Amount appropriated by sundry civil act approved March 3, 1903.....	200,000.00

	300,000.00
June 30, 1903, amount expended during fiscal year	2,120.16

July 1, 1903, balance unexpended.....	297,879.84
---------------------------------------	------------

July 1, 1903, amount covered by uncompleted contracts.....	297,879.84
--	------------

{ Amount (estimated) required for completion of existing project.....	81,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	81,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix V V 5.)

6. *San Joaquin River, California.*—Before improvement the low-water channel to Stockton was 6 feet in depth, and contained several sharp bends where navigation was difficult, while the upper river above Stockton was navigable only during high water, which lasted only a few months in the year.

Project for improvement, which was made and approved in 1877, and slightly modified in 1881 and 1882, had for its object to secure

and maintain by dredging a channel 9 feet deep at low water and 80 feet wide to Miller's warehouse; as also the temporary improvement of the upper river by snagging, scraping, removal of bars, and the partial closure by weirs of Laird Slough and Paradise Cut.

The amount expended on this work to June 30, 1903, was \$448,263.77, and the results obtained have been the maintenance of a channel to Stockton, 9 feet in depth at low water, 100 feet wide, and the straightening of the channel by cut-offs as follows: Three at Devils Elbow, one at Head reach, two at the Narrows, and two at Twenty-one Mile Slough, all of which reduced the length of the river by $4\frac{1}{2}$ miles. The upper river has been improved by snagging and the construction of weirs at Paradise Cut and Laird Slough.

On two occasions in the past fiscal year immense quantities of detritus came through Mormon channel and lodged in Stockton channel. Once the latter channel was filled throughout its length with a deposit which averaged 8 feet in height, and which seriously interfered with navigation. Emergency contracts for the removal of this shoal by dredging were immediately made, which occasioned an expense of about \$20,000 in the past ten months.

The total amount expended on the existing project at the close of the fiscal year ending June 30, 1903, was \$448,263.77, the amount covered by uncompleted contracts being \$6,408.21 additional. As all the money spent during the past fiscal year was for dredging in Stockton channel, the expenditure might be said to be for maintenance.

There has been obtained and generally maintained a channel to Stockton, 100 feet wide and 9 feet deep at low water. Commerce has not required, and the funds have been insufficient to maintain, the depth of 4 feet in Mormon channel. In places the channel below Miller's warehouse is practically bare at low-water stages.

On June 30, 1903, 9 feet at low water could be carried to Stockton. The range of tides is about 2 feet. The river is always navigable to Stockton. The head of navigation is at Firebaugh. This point is now rarely reached by boats.

The improvement has been of great value to Stockton, and the commerce by river exceeds 300,000 tons annually. On the upper river, at low stages, all the water is taken from the river for irrigation by a dam located above Firebaugh.

On account of the great distance to which material dredged will have to be pumped and impounded, the engineer officer in charge estimates that the future cost of dredging for maintenance of channel will considerably exceed that paid in recent years.

July 1, 1902, balance unexpended	\$34,705.99
June 30, 1903, amount expended during fiscal year.....	13,469.76
July 1, 1903, balance unexpended	21,236.23
July 1, 1903, amount covered by uncompleted contracts.....	6,408.21

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	35,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix V V 6.)

7. *Stockton and Mormon channels, San Joaquin River, California.*—The river and harbor act of June 13, 1902, provides for improvement

of this locality in accordance with report printed in House Document No. 152, Fifty-fifth Congress, third session, and in the Annual Report of the Chief of Engineers for 1899, page 3189. The plan of improvement proposes the diversion of the waters of Mormon channel, to be accomplished by means of a dam to be located about 3 miles east of Stockton, and the construction of a canal 24,850 feet long, 150 feet wide at the bottom, thence to the north branch of Calaveras River, the estimated cost being \$255,016, which includes the cost of dredging in the river, purchase of right of way, changing of grades of highways and bridges, and dredging in Mormon and Stockton channels.

The act authorizes the letting of a continuing contract in the sum of \$175,000, exclusive of the amount appropriated, for completing the project.

The act of June 13, 1902, requires in its provisions "that the city of Stockton or the State of California shall first furnish to the United States the right of way for said canal." The legislature of the State of California, at its recent session, appropriated money with which to acquire the right of way above referred to.

No work has yet been done.

July 1, 1902, balance unexpended	\$50,000.00
Amount appropriated by sundry civil act approved March 3, 1903	50,000.00

July 1, 1903, balance unexpended	100,000.00
--	------------

{ Amount (estimated) required for completion of existing project	124,316.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.	124,316.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix V V 7.)

8. *Mokelumne River, California.*—This river is a tributary of the San Joaquin, is a tidal stream, and is navigable in fact to Bensons Ferry bridge, about 18 miles above the mouth of the river. Benson's bridge is without a draw, and obstructs navigation beyond it. Steamboats run regularly to New Hope Landing, about 13½ miles above the mouth of the river.

Before improvement, navigation was difficult on account of overhanging trees, snags, and a shoal opposite New Hope Landing. In 1881 a project was submitted to remove overhanging trees, logs, and snags from the river, at an estimated cost of \$8,250, occasional snagging to be required thereafter to maintain navigation.

In 1890 this project was extended to close a canal which entered the river, and to remove a sand bar and point of land near and opposite New Hope Landing, as well as to continue to remove snags and overhanging trees occasionally as might be required.

Appropriations beginning in 1884, and continued in 1886, 1888, 1892, and 1894, aggregating \$18,000, have been made by Congress for carrying out the project. The work has been completed. The amount expended to June 30, 1903, was \$17,111.66.

At present there is no obstruction to navigation in the river below New Hope Landing. Between New Hope Landing and Benson's bridge there are numerous snags and overhanging trees. This part of the river is seldom used, and only by sailboats or launches.

The amount of commerce varies with the crops. All that grows on or near the banks of the river is transported by the water route, which

in 1901 was reported as being 81,701 tons, and in 1902 amounted to 43,299 tons.

Two stern-wheel steamboats, each of about 400 tons measurement, ply regularly on the river.

No work has been done on the river since 1896, and the channel below New Hope Landing, which has a 3-foot depth at low water, remains in good condition. There is a tidal range on the river of nearly 4 feet.

In case the snags and overhanging trees were again removed between New Hope Landing and Benson's bridge, the upper $4\frac{1}{2}$ miles of river would be materially improved, the estimated cost of which is \$2,500. Over this stretch of river there is a least low-water depth of about 2 feet, and the country on both banks of the river is rich and highly cultivated.

The head of navigation in fact of this stream is at Benson's bridge. An act of the California legislature declares the river a navigable stream to the first falls, which an old settler reports as being fully 20 miles above Benson's bridge.

July 1, 1902, balance unexpended	\$888. 34
July 1, 1903, balance unexpended	888. 34
July 1, 1903, outstanding liabilities	12. 60
July 1, 1903, balance available	875. 74

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	2, 500. 00
	{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix V V 8.)

9. *Sacramento and Feather rivers, California.*—An act of Congress of June 3, 1896, provided for the appointment of a Board of three engineer officers for the purpose of carrying on the improvement of the Sacramento and Feather rivers.

Before improvement the condition of the river below Sacramento was such that boats drawing about 7 feet of water could at low-water stage reach Sacramento. Thereafter, on account of hydraulic mining, the river shoaled so much that only 4 feet could be carried to that city. Above Sacramento navigation was difficult and dangerous, and for ten years, from 1882 to 1892, was closed above McIntosh Landing, about 44 miles below Redbluff, on account of numerous shoals, snags, and rapids.

The date of the original project for the improvement of these rivers is uncertain. Old reports refer to the project of 1874 which contemplated the improvement of the low-water channels of both rivers by removing snags, scraping bars, and the construction of temporary wing dams. Work of the character above described began in 1875-76 and has continued annually ever since when funds permitted. In 1890 and 1892 the project was extended to close some crevasses and for a treatment of the Yuba River near Marysville.

In 1891 a Board of Engineers recommended for further improvement of the rivers: First. A specific annual appropriation of \$25,000 for snagging and wing-dam construction above Sacramento. Second. An appropriation of \$275,000 for removal of obstructions in the river

below Sacramento. Third. An appropriation of \$300,000 for the treatment of the Yuba River at and above Marysville. Fourth. An annual appropriation of \$20,000 for improving the navigable channel of the Feather River. In 1894 a Board of Engineers examined the Sacramento River between Redding and Redbluff, which is above the present head of navigation. The report was unfavorable. The estimated cost of improving that stretch of river was \$7,500,000.

A Board of Engineers, appointed in compliance with the act of Congress of June 3, 1896, submitted a project for the construction of wing dams at numerous shoal places below Sacramento, to be supplemented by dredging if required, at an estimated cost of \$280,000; the maintenance of navigation on the upper river as far as Redbluff by construction works, and the removal of snags, at an estimated annual cost of \$25,000.

The existing project is that submitted by the Board of 1896. Congress, by act of March 3, 1899, appropriated \$30,000 and authorized continuing contracts to the limit of \$280,000, in accordance with recommendations of the report of the Board.

The amount expended on the original project prior to operations under the existing project—that is, prior to June 30, 1899—was \$725,838.83; the amount expended on the existing project to June 30, 1903, was \$84,966.42, making a total expended on the original and existing projects to June 30, 1903, of \$810,805.25.

The result in the way of increased depth and benefit to navigation is that the depth contemplated to Sacramento, viz, 7 feet at low water, has been obtained and maintained during the past two years. This has greatly benefited navigation and at an expense of only \$36,251.09, an amount very much below the estimate.

On the upper river snagging and temporary improvement has been done as far as possible with the \$25,000 appropriated June 13, 1902. At low-water stages of the river 4 feet can be carried from Sacramento to Colusa, and about 26 inches from Colusa to Redbluff. The river is navigable in fact to Redbluff.

Unless other shoals should develop below Sacramento, it is believed that no work of any consequence, other than snag removal, maintenance and slight repairs to existing wing dams, will be required on the lower river.

In the reports of the Board of Engineers for 1897–98, printed in House Document No. 186, Fifty-fifth Congress, third session, referred to in the appropriation act of March 3, 1899, snagging in the lower river was not mentioned, and by a strict construction of said act no money appropriated therein would be available for snagging below Sacramento. Snags accumulate in that part of the river and must be removed to maintain navigation. The Board recommends that any unexpended balance from the appropriation for improving Sacramento River below Sacramento be made available for use anywhere on the river, and invites attention to the fact that, since the Board's report was made recommending an annual appropriation of \$25,000 for use on the upper river for snagging, only one appropriation of \$25,000 has been made which by the language of the act became available anywhere on either river. Funds therefrom were used during the fiscal year just closed, and from the unexpended balance available from this appropriation the snag boat will have to be repaired. She can not be used during the present sea-

son on account of lack of funds, and navigation of the upper river will be seriously interfered with.

In addition to the annual appropriation of \$25,000 heretofore recommended, the Board urgently recommends that the unexpended portion appropriated for the lower river be made available throughout the entire area, and that legislation be enacted with a view to providing for uninterrupted work of operating snag boats on the Sacramento River for the removal of snags, wrecks, and other obstructions to navigation, and authorizing the Secretary of War, upon the application of the Chief of Engineers, to draw a warrant from time to time upon the Secretary of the Treasury for such funds as may be necessary to do such work, not to exceed \$25,000 per year, and that an itemized statement of said expenses accompany the Annual Report of the Chief of Engineers.

There is now a slight tidal influence felt at Sacramento, where the vertical range of river is about 21 feet. The tidal range at the mouth of the river is about 7 feet. No reduction has been reported in transportation or insurance rates, nor has the volume of business by river increased in consequence of the improvement.

Financial account shows condition of both appropriations, viz, below Sacramento, and Sacramento and Feather rivers.

SACRAMENTO AND FEATHER RIVERS, CALIFORNIA.

July 1, 1902, balance unexpended	\$25,057.04
Amount received from sales of condemned property	73.80
	25,130.84
June 30, 1903, amount expended during fiscal year	14,611.20
July 1, 1903, balance unexpended	10,519.64
{ Amount (estimated) required for completion of existing project....	Indeterminate.
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1905, for works of improvement and for maintenance, in addition to	
{ the balance unexpended July 1, 1903	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
{ 4, 1897, and of section 7 of the river and harbor act of 1899.	

SACRAMENTO RIVER BELOW SACRAMENTO, CAL.

July 1, 1902, balance unexpended	\$57,788.29
June 30, 1903, amount expended during fiscal year	4,039.38
July 1, 1903, balance unexpended	53,748.91

(See Appendix V V 9.)

10. *Petaluma Creek and Napa River, California.*—(a) *Petaluma Creek.*—This creek is 16 miles in length, is an estuary of San Pablo Bay, and is navigable to Petaluma, a town of about 4,000 inhabitants, situated at the head of navigation.

Before improvement it was very crooked, dry in places at low water, and navigation was dependent entirely on the tides. Project was made in 1880, and approved, for straightening the creek by making three cut-offs, and dredging to obtain a channel 50 feet wide and 3 feet deep at low water, estimated to cost \$25,868. In 1892 the project was extended (approved August 5, 1892) to dredge the channel as deep as funds would permit.

Dredging was begun in 1881 and continued in 1884, and again in

1888, 1891, 1893, 1895, 1896, and 1900. The total amount expended to June 30, 1903, was \$64,730.07; the balance available is \$3,269.93.

In consequence of the improvements, a channel 6 feet deep at low water has been obtained in the lower part of the creek, and one 4 feet deep at low water to the head of navigation. The channels were fully 50 feet in width. These depths were not and can not be maintained without periodical dredging, as the creek drains a large and very rich agricultural area of about 83 square miles. The annual freshets bring down large quantities of detritus, which is deposited in the channels, and as there is no tidal basin above the town the tides do not scour out this deposit.

The commerce is large and increasing, and the maintenance of navigation on the creek regulates the railroad freight rates for this section of country.

The least depth is 4 feet to Haystack Landing, a slightly less depth to entrance to canal 1.2 miles below Petaluma, and above the canal entrance in places the creek is bare at low tide.

Petaluma is the head of navigation.

(b) *Napa River*.—This river before improvement had a low-water depth of 5 feet, except at the bars near and a short distance below the town of Napa, which had a depth of less than 1 foot on their crests. The ordinary range of tides was about 5 feet.

Project for the improvement was made in 1888, which proposed to dredge the bars as far down river as Carrs Bend and to cut off projecting points of land, with a view to obtain a channel 75 feet wide and 4 feet deep at mean low water, and to remove obstructions, such as logs, snags, etc., estimated to cost \$27,600.

Examination was again made in 1896 and in 1899, with an estimate of cost of \$3,600 for continuing improvement, and for which funds were available. Another examination and report thereon was made in August, 1902.

The existing project as approved is simply the old project, viz., to obtain by dredging a channel 75 feet wide, 4 feet deep at low water, and to remove any obstructions, such as logs, snags, etc., that interfere with navigation.

Congress approved the former projects by appropriating money in 1888, 1890, 1894, and 1896, aggregating \$25,500, and in the act of June 13, 1902, by appropriating \$6,000 jointly for improvement and maintenance of Petaluma Creek and Napa River, from which amount \$3,000 was allotted to Napa River, thus making the total available for Napa River \$28,500.

Work was begun in accordance with the project in 1889, and has been carried on ever since when work was necessary and funds permitted. Up to June 30, 1903, the amount expended on the improvement was \$25,093.03, and the unexpended balance available is \$3,406.97.

A channel 4 feet deep and 75 feet wide has been obtained, but it is not permanent, and can not be maintained without frequent dredging, as annual freshets bring down large deposits which lodge on the bars. All logs and snags endangering navigation have also been removed.

No work has been done on the river during the past fiscal year.

The last dredging was done in 1900, at which time 27,648 cubic yards of material was removed, at a cost of \$3,621.42.

At present there is not more than 1 foot depth at low tide over some

of the worst bars below Napa. The steamboats run daily and take advantage of the tides.

The commerce of the river for 1901 was 108,526 tons; for 1902 it is reported as 67,620 tons.

The head of navigation is Napa.

All of the balance available will probably be expended for dredging by June 30, 1904, and \$3,000 can be used to advantage in the fiscal year ending June 30, 1905, for maintenance and continuing improvement.

Report of the examination authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$6,683.34
June 30, 1903, amount expended during fiscal year	6.44
July 1, 1903, balance unexpended	6,676.90

(Amount (estimated) required for completion of existing project.... Indeterminate.	
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903.....	6,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix V V 10.)

11. *Humboldt Harbor and Bay, California.*—Before improvement this harbor was obstructed by a troublesome bar about a mile seaward of the entrance, through which a channel 25 feet in depth was occasionally found for short periods, but more frequently channel depths of from 9 to 15 feet could be carried. These channels changed in azimuth over a range fully $1\frac{1}{2}$ miles in length, and vessels were often storm bound in the harbor for several weeks. Inside the harbor are the towns of Eureka, Arcata, Fields Landing, and Hookton, in front of each of which shoals existed.

In 1881 a project was adopted for securing by dredging a channel 12 feet deep and 200 feet wide in front of Eureka, and channels of 10 feet depth and 100 feet width to Arcata and Hookton, respectively. This work was completed by contract in 1884 at a cost of \$80,884.69.

In 1882 a project was adopted for improving the entrance to the harbor by the construction of a low-tide brush and rock jetty, to commence at the south spit and to extend seaward for a length of about 6,000 feet, estimated to cost \$600,000. In 1891 a Board of Engineer officers recommended a modification of this project, to consist of two high-tide jetties, nearly parallel to each other, and about 2,100 feet apart, to extend from the north and south spits, respectively, seaward to the 18-foot contour of depth on the bar, and to build groins on these jetties if necessary. The estimated cost of the entire work for improving the entrance was \$2,057,615. The project was approved on March 21, 1891.

The river and harbor act of July 13, 1892, authorized the work to be placed under the continuous-contract system. Actual work was commenced in May, 1889, and was completed in August, 1899. All the work was done by contract, and cost \$2,040,203.35. The north jetty had a length of 8,068 feet; the south jetty was 7,408 feet in length. Since completion, the only expense has been for the services

of a watchman, moving some of the buildings, office expenses, and a recent survey of the entrance and the harbor.

On March 27, 1899, a project was approved for dredging a channel 15 feet deep, 8,900 feet long, and 200 feet wide in front of the town of Eureka. The estimated cost was \$50,000. The work was done by contract and completed in March, 1901, at a cost of \$50,000, of which \$2,134.05 was for engineering expenses.

The total amount expended on the various existing projects to June 30, 1903, above referred to, all of which are completed, was \$2,176,009.03.

The improvement has resulted in obtaining a channel over the bar at the entrance 31 feet in depth and 250 feet in least width. The dredged channel in front of the wharves at Eureka, which was 15 feet deep and 200 feet in width, has shoaled somewhat. The mean tidal range is about 5.5 feet. Humboldt Harbor is navigable to Arcata in the north bay and to Hookton in the south bay.

The volume of commerce has not as yet greatly increased in consequence of the improvement. Its chief advantage lies in the fact that vessels can now cross the bar at any time without detention on account of shallow water.

No additional work seems necessary.

A detailed history and description of the work done at the entrance to the harbor can be found in the Annual Report of the Chief of Engineers for 1900.

July 1, 1902, balance unexpended	\$13,339.74
June 30, 1903, amount expended during fiscal year	1,733.77

July 1, 1903, balance unexpended	11,605.97
--	-----------

(See Appendix V V 11.)

12. *Pearl Harbor, Hawaii.*—Pearl Harbor is situated on the Island of Oahu, about 8 miles west of the city of Honolulu. It is a safe and commodious harbor, with deep water except at the entrance, which was obstructed by a bar which at low water had a least depth of 10 feet of water over it, which made the harbor unavailable for commercial or naval purposes.

A full description of the harbor is printed in Senate Executive Document No. 42, Fifty-third Congress, third session.

The river and harbor act of March 3, 1899, provided as follows: "Improving Pearl Harbor, Hawaii, in accordance with the report submitted by Rear-Admiral Walker, July 11, 1894, and contained in Senate Executive Document No. 42, Fifty-third Congress, third session: Completing improvement, \$100,000."

Contract for dredging a channel 30 feet deep at low water and as wide as funds would permit (about 200 feet), estimated to cost \$100,000, was approved on July 25, 1901. The contract price for dredging is 44½ cents per cubic yard, place measurement.

Work was commenced with inadequate plant in March, 1902, and poor progress was made during the fiscal year ending June 30, 1902, when only about 20,000 cubic yards of material had been dredged. During the past fiscal year two suction dredges were obtained by the contractors. On November 18, 1902, one of these, belonging to the Hawaiian government, but under charter to the contractors, was sunk on the bar during a gale and proved a total loss. Fortunately, after sinking, the wreck, in consequence of heavy seas, was forced

out of the channel and lodged on the coral reef adjacent. The other suction dredge, considering the heavy swells encountered, did fairly good work.

The amount expended on the work to June 30, 1903, was \$71,447.38.

On June 30, 1903, a channel had been obtained throughout the length of the bar essentially 30 feet in depth, with occasional small areas of slightly less depth, which were then being removed. The improved channel was about 200 feet in width. It is believed that 28 feet at low water could be carried on June 30, 1903, over the shoalest part of the locality under improvement. The tidal range is between 12 and 18 inches. The harbor was then navigable throughout its entire area.

Under date of August 19, 1903, the local officer reported that this work was completed on August 2, 1903.

As yet there has been no commercial activity in the harbor. On its borders are very large and thrifty sugar plantations, the products from which can now be shipped direct by sea. The greatest advantages from the improvement will be in furnishing a safe, deep, and commodious harbor for our naval vessels.

July 1, 1902, balance unexpended	\$98,017. 74
June 30, 1903, amount expended during fiscal year	69,465. 12
July 1, 1903, balance unexpended	28,552. 62
July 1, 1903, amount covered by uncompleted contracts	22,237. 33
(See Appendix V V 12.)	

IMPROVEMENT OF RIVERS AND HARBORS IN WESTERN OREGON, OF COLUMBIA RIVER ABOVE THE MOUTH OF WILLAMETTE RIVER, AND OF SNAKE RIVER, OREGON AND WASHINGTON.

This district was in the temporary charge of Maj. W. C. Langfitt, Corps of Engineers. Division Engineer, Lieut. Col. W. H. Heuer, Corps of Engineers.

1. *Coquille River, Oregon.*—This stream empties into the Pacific Ocean at Bandon, Coos County, Oreg., about 375 miles north of San Francisco. Once safely across the bar at the mouth of the river vessels drawing about 11 feet of water experience no special difficulty in ascending the stream at high tide to the town of Coquille, about 25 miles above Bandon.

Before improvement the channel at the mouth of the river skirted the south headland for some distance, as shown on map opposite page 2682 of the Annual Report of the Chief of Engineers for 1882, and was shoal, shifting, and studded with dangerous rocks. The depth of the water on the ocean bar at the original mouth of the river was usually about 3 feet at low tide, or a little over 7 feet at high tide.

The original plan for improvement was approved in 1873, and provided for the construction of two converging high-tide jetties, built of rubblestone, 800 feet apart, so located as to cause the river to empty into the sea about one-half mile north of the original mouth of the river, these jetties to run out to sea a sufficient distance to create and maintain a channel 12 feet deep at low tide. In 1880 the proposed depth of 12 feet at low tide, to be obtained in the channel at the new mouth of the river, was reduced to 10 feet; in 1888 it was reduced to 8 feet, and under date of May 8, 1891, the plan was changed to provide that

the jetties should be 600 feet apart at their outer ends, instead of 800 feet.

The amount expended on original and modified projects prior to operations under existing modified project was \$102,299.98, including \$6,883.90 for snagging.

The existing modified project may be said to date from 1892, when the lengths of the proposed jetties were definitely fixed, and the character of the construction changed by adopting jetties more in conformity to those at Coos Bay and Yaquina Bay.

The estimated cost for completing the improvement, including previous appropriations (and including \$6,883.90 expended in removing snags in the river between Coquille and Myrtle Point, under acts of Congress of August 11, 1888, and September 19, 1890), was increased from \$164,200 to \$285,000. The modified project was approved by the Chief of Engineers February 20, 1892.

A rock about 120 feet long by 50 feet wide exists in the channel, near the mouth of the river, the top of which is 2 feet below the surface at mean low tide. This rock is a menace to navigation, having already caused slight injuries to several vessels. An attempt has been made to remove this obstruction, but it was found to be of greater dimension than was thought and the attempt was abandoned. The rock should be removed to a depth of at least 8 feet, or possibly a spur jetty built between it and the south jetty to divert the ship channel from it to the north.

The expenditures on the original and modified projects to June 30, 1903, amount to \$217,198.33, of which the sum of \$20,874.41 was for maintenance.

The expenditures for the fiscal year ending June 30, 1903, amounting to \$9,146.51, were for continuing the improvement by extending the north jetty seaward 360 feet, laying a foundation mattress of brush fascines and depositing thereon an enrockment of rubblestone.

The materials were purchased and placed in the work under contract with John Kiernan, dated November 10, 1902.

The total expenditures to date on the original and modified projects have resulted in completing the south jetty throughout its projected length of about 2,700 feet, in constructing about 870 feet of the proposed north jetty, and in removing some of the principal snags obstructing navigation between Coquille and Myrtle Point.

The work so far done has resulted in closing up the dangerous old channel at the mouth of the river and has opened up a new channel straight out to sea, with a controlling bar depth ranging from 4 to 10 feet at mean low tide.

The maximum draft that could be carried June 30, 1903, at mean low tide in the new channel at the mouth was about 6 feet, although the bar is generally crossed at high tide. The average daily range of tide on the Coquille bar is 4.2 feet.

The principal articles of commerce carried over the bar in the ocean at the mouth of the river are lumber and coal. This commerce is loaded on small coasting vessels along the 25 miles of the river between its mouth and Coquille, and by them taken to San Francisco for market. The river and ocean form the only practicable means for transporting the commerce of the region to market.

For further details as to original and modified project, see Annual

Reports of the Chief of Engineers for 1879 (page 1806) and 1892 (pages 2664-2665).

Commercial statistics.

Year.	Tons.	Year.	Tons.
1879	7,000	1893	14,491
1882	6,630	1894	14,180
1883	9,438	1895	16,256
1884	13,100	1896	21,106
1885	7,649	1897	25,620
1886	9,080	1898	24,566
1887	6,681	1899	26,654
1888	29,197	1900	30,727
1889	29,309	1901	32,975
1891	16,994	1902	37,458
1892	19,362		

NOTE.—The statistics for 1895-1902, inclusive, are for calendar years; those for years prior to 1895 are for fiscal years ending June 30. Statistics for years not named are not available.

July 1, 1902, balance unexpended	\$31,948. 18
June 30, 1903, amount expended during fiscal year	9,146. 51
July 1, 1903, balance unexpended	22,801. 67
July 1, 1903, outstanding liabilities	3,088. 10
July 1, 1903, balance available	19,713. 57
July 1, 1903, amount covered by uncompleted contracts	19,000. 00
{ Amount (estimated) required for completion of existing project	45,000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	30,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W W 1.)

2. *Entrance to Coos Bay and Harbor, Oregon.*—Coos Bay is a tidal estuary on the Pacific coast in Oregon, about 400 miles north of San Francisco. It is the principal harbor between the mouth of the Columbia River and San Francisco. Before improvement the obstructions consisted of the usual bar in the ocean at the entrance to the bay and shoals inside the bay near its entrance, formed by sand which accumulated during northwesterly winds. Under the influence of these winds the sand spit on the north side of the entrance advanced toward the south, contracting the channel under the high stone headland, known as Coos Head, on the south side of the entrance, to a very narrow width, and usually causing the channel across the bay in the ocean at the entrance to follow the west side of the north spit in a tortuous course. The depth on the ocean bar was often but 10 feet at low tide.

The original project for the improvement of Coos Bay received the approval of the Secretary of War November 24, 1879.

It provided for the construction of a jetty from a point about 250 yards below the southern extremity of Fossil Point on a line toward the east end of Coos Bay, this line curving so as to be directed at its outer end to the head, or a little north of it, the structure to be of wood and stone, or stone, as should be found best. The estimated cost was \$600,000.

The amount expended on the original project was \$213,750. Under

the original project 1,760 feet of timber crib and rubblestone jetty was built.

The existing project provides for obtaining and maintaining a channel 20 feet deep at low tide through the ocean bar at the entrance to the bay by confining the entrance between two high-tide rubblestone jetties, the north jetty to be 9,600 feet long and the south jetty 4,200 feet long.

The estimated total cost of the existing project, exclusive of the amount expended on the original project, is \$2,466,412.20. This project was approved by the Chief of Engineers September 23, 1890. The amount expended thereon up to the close of the fiscal year ending June 30, 1903, is \$668,420.63, of which \$143,420.63 was for maintenance of improvement.

The expenditures on this improvement to date have resulted in the construction of the submerged jetty near Fossil Point, under the original project, and in completing the 9,600-foot north jetty, running out to sea from the southern end of the north sand spit, as provided for in the present project.

Since the completion of the north jetty a straight channel through the ocean bar has been maintained having ordinarily a least depth of from 18 to 22 feet at mean low tide.

A comparison of the maps printed in Annual Reports of the Chief of Engineers for 1884 (p. 2264) and for 1900 (p. 4278) will show the improved condition of the bar channel.

Vessels which can cross the bar can pass up to Marshfield, the principal town on the bay, about 13 miles from the entrance, but when fully loaded are somewhat delayed by an obstructive shoal in the channel opposite Pony Slough. The maximum draft that could be carried across the bar at mean low tide June 30, 1903, is about 16 feet. The mean rise and fall of tide on Coos Bay bar is 4.8 feet.

The expenditures during the fiscal year ending June 30, 1903, were limited to caring for the Government plant used in the work of construction in past years and the transplanting of about 62 acres of Holland grass roots on the north spit.

A recommendation that the funds available be withheld owing to the relatively small amount and to the fact that the depths contemplated by the project had been obtained and fairly well maintained, was approved.

A recent examination showed but 17 feet depth on the crest of the bar at mean lower low water. Should the shoaling which is thus shown not prove temporary or increase, further work will soon be necessary. It is hoped this will not be the case.

The funds available will therefore be used for maintaining the present north jetty until such time as further funds are appropriated and necessity for their expenditure shown.

The commerce that crossed the bar at the entrance to Coos Bay consists principally of lumber and coal, originating at points on and adjacent to the bay. Practically all of the commerce is marketed in San Francisco, to which point it is taken by coasting vessels. The bay and ocean form the only practicable means of transporting the commerce to market.

For further information as to project, etc., see Annual Report of the Chief of Engineers for 1890, pages 2936-2965.

\$155,212.10, of which \$3,511.27 was for maintenance, was for the construction of about 4,090 feet of the north jetty, which includes tramway approach 3,029 feet long at the shore end of the jetty, and for surveys of the bar and river.

This expenditure has resulted in somewhat checking the tendency of the bar channel to shift its position as far north as often occurred before the work of improvement was commenced. No work has been done on the projected south jetty, as the original project provides that the north jetty shall be constructed first, at least in part.

The expenditures during the fiscal year ending June 30, 1903, were for properly caring for the Government plant used in the construction of the north jetty in past years, and in making a survey of the bar and river as far up as Acme.

The river and harbor act of June 13, 1902, contains the following item relative to the improvement of this stream:

Continuing improvement, thirty-five thousand dollars, and the Secretary of War is authorized and directed to cause to be made a reexamination and survey of said river at its mouth, and at the shoals at or near Florence, with a view to the adoption of a project for the improvement of said river which will provide for its commerce at a less cost than the existing project.

The reexamination and survey were made in August and September, 1902, and a report thereon, dated February 5, 1903, submitted to the Chief of Engineers. The Board of Engineers for Rivers and Harbors, to which this report was referred, reported March 26, 1903—

That in its opinion it is not desirable to continue the improvement of the Siuslaw River with the view of obtaining a depth of 8 feet.

These reports are herewith in Appendix W W 12.

The maximum draft that could be carried over the bar at mean low tide on June 30, 1903, is about 7 feet.

The average range of the tide on the bar is 5.2 feet.

Vessels which cross the bar can ascend the river to a point a short distance above Florence, which is about 5 miles from the entrance, and light-draft steamboats can navigate the river to the head of tide, about 15 miles above Florence.

The commerce of the Siuslaw River is limited at present, the country being thinly settled. There is much timber in the vicinity and lumber is the principal article of commerce at this time and the industry is growing. The ensuing year will witness the addition of a new sawmill and tug to the business of the river.

The lumber is transported to San Francisco in small coasting vessels. The river and ocean form the only means of transporting the commerce to market, there being no railroad in the vicinity.

Comparative statement of traffic.

Year.	Tons.	Year.	Tons.
1892	2, 381	1898	4, 350
1893	7, 000	1899	4, 907
1894	8, 050	1900	18, 675
1895	15, 296	1901	22, 361
1896	7, 184	1902	25, 213
1897	2, 239		

NOTE.—The statistics for 1896–1902 are for calendar years; for years prior to 1896 they are for fiscal years ending June 30.

The average rise of tide in the portion of the river between its mouth in the bay and the head of navigation is about 5 feet, which gives ample depth of water for the purposes of navigation. Coos River flows through a narrow but productive valley. The commerce carried on the small boats plying the stream consists principally of farm and dairy products, which are brought to Marshfield on Coos Bay, where ocean vessels take them to market. On account of the formation of the country the stream is the only means of transporting the commerce to market.

Comparative statement of traffic.

Year.	Tons.	Year.	Tons.
1896	13, 204	1900	b 229, 225
1897	16, 534	1901	62, 402
1898	22, 674	1902	c 46, 000
1899	a 70, 007		

NOTE.—The above statistics are for calendar years.

a Includes 21,852 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

b Includes 170,400 tons of stone for the Government jetty at the entrance to Coos Bay, Oregon.

c Approximate.

July 1, 1902, balance unexpended	\$2, 000. 00
July 1, 1903, balance unexpended	2, 000. 00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W W 3.)

4. *Mouth of Siuslaw River, Oregon.*—The Siuslaw River empties into the Pacific Ocean at a point about 475 miles north of San Francisco, Cal. It enters the sea through a shifting sand beach without headlands or other fixed points to mark the entrance, which is obstructed by a shoal outer bar. Before the work of improvement was commenced the channel across this outer bar frequently shifted its position up or down the coast as much as 1 mile, and the depth of water on the bar varied from 5 to 12 feet at low tide.

The original project for improvement was approved by the Secretary of War August 4, 1891 (report printed in the Annual Report of the Chief of Engineers for 1891, pp. 3175–3182), and provided for confining the mouth of the river in the ocean between two high-tide rubble-stone jetties, the north jetty to be 7,500 feet long, including a tramway approach at its shore end 3,000 feet long, and the south jetty to be 5,600 feet long, including a tramway approach at its shore end 2,400 feet long. These jetties were designed to hold the channel across the bar in the ocean at the mouth of the river in one position, and to maintain the depth of 8 feet at low tide in the bar channel.

The estimated cost of the improvement under the original project was \$700,000. The charts opposite page 3174 and page 3178 of the Annual Report of the Chief of Engineers for 1891 show the positions of the proposed jetties of the original project.

The amount expended on the original project to June 30, 1903,

\$155,212.10, of which \$3,511.27 was for maintenance, was for the construction of about 4,090 feet of the north jetty, which includes tramway approach 3,029 feet long at the shore end of the jetty, and for surveys of the bar and river.

This expenditure has resulted in somewhat checking the tendency of the bar channel to shift its position as far north as often occurred before the work of improvement was commenced. No work has been done on the projected south jetty, as the original project provides that the north jetty shall be constructed first, at least in part.

The expenditures during the fiscal year ending June 30, 1903, were for properly caring for the Government plant used in the construction of the north jetty in past years, and in making a survey of the bar and river as far up as Acme.

The river and harbor act of June 13, 1902, contains the following item relative to the improvement of this stream:

Continuing improvement, thirty-five thousand dollars, and the Secretary of War is authorized and directed to cause to be made a reexamination and survey of said river at its mouth, and at the shoals at or near Florence, with a view to the adoption of a project for the improvement of said river which will provide for its commerce at a less cost than the existing project.

The reexamination and survey were made in August and September, 1902, and a report thereon, dated February 5, 1903, submitted to the Chief of Engineers. The Board of Engineers for Rivers and Harbors, to which this report was referred, reported March 26, 1903—

That in its opinion it is not desirable to continue the improvement of the Siuslaw River with the view of obtaining a depth of 8 feet.

These reports are herewith in Appendix W W 12.

The maximum draft that could be carried over the bar at mean low tide on June 30, 1903, is about 7 feet.

The average range of the tide on the bar is 5.2 feet.

Vessels which cross the bar can ascend the river to a point a short distance above Florence, which is about 5 miles from the entrance, and light-draft steamboats can navigate the river to the head of tide, about 15 miles above Florence.

The commerce of the Siuslaw River is limited at present, the country being thinly settled. There is much timber in the vicinity and lumber is the principal article of commerce at this time and the industry is growing. The ensuing year will witness the addition of a new sawmill and tug to the business of the river.

The lumber is transported to San Francisco in small coasting vessels. The river and ocean form the only means of transporting the commerce to market, there being no railroad in the vicinity.

Comparative statement of traffic.

Year.	Tons.	Year.	Tons.
1892	2,881	1898	4,350
1893	7,000	1899	4,907
1894	8,050	1900	18,675
1895	15,296	1901	22,351
1896	7,184	1902	25,213
1897	2,239		

NOTE.—The statistics for 1896-1902 are for calendar years; for years prior to 1896 they are for fiscal years ending June 30.

600 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

July 1, 1902, balance unexpended	\$35,299.17
June 30, 1903, amount expended during fiscal year	3,511.27
July 1, 1903, balance unexpended	31,787.90
Amount (estimated) required for completion of existing project.....	513,000.00
(See Appendix W W 4).	

5. *Yaquina Bay, Oregon.*—Yaquina Bay is a small tidal estuary of about 5 square miles area lying on the Oregon coast, about 110 miles south of the mouth of the Columbia River. The usual bar exists in the ocean at the entrance to the bay. Prior to improvement the prevailing depth on this bar was only about 7 or 8 feet at low tide, and three distinct channels existed at the entrance to the bay.

The original project for the improvement of Yaquina Bay was approved by the Secretary of War January 14, 1881, and provided a plan for expending the appropriation of \$40,000 of act of June 14, 1880, by the building of a short wooden crib jetty on the south side.

The project was amended in 1882, when the amount estimated for completion was \$355,000.

The project was modified again in 1888 and in 1892.

Under the original and modified projects there were constructed a rubblestone jetty running out to sea 3,500 feet from the south beach and a rubblestone jetty running out to sea about 2,800 feet from the north head.

The total amount expended on the original and modified projects prior to operations under existing project is about \$690,000.

The construction of these jetties resulted in closing up two of the three channels formerly existing, in developing the third channel, and in obtaining from 14 to 15 feet of water on the bar at mean low tide, or from 21 to 22 feet at high tide.

As the project called for but 17 feet at high tide, it is considered to have been satisfactorily completed.

The existing project was approved by act of Congress of June 6, 1900, and provided for removing a cluster of rocks located about 2,000 feet beyond the sea end of the south jetty, pursuant to the river and harbor act of June 6, 1900, at an estimated cost of \$20,000, in accordance with report submitted by a Board of Engineers, November 14, 1899.

The amount expended on the existing project to June 30, 1903, is \$15,928.02.

The expenditures to date have resulted in completing the two jetties provided for by the original and modified projects, as stated above, and in removing the clusters of rocks in the bar channel under the provision of the act of June 6, 1900, to a depth of 12 or 13 feet below mean low tide.

No work was carried on during the past fiscal year, and the small expenditure to June 30, 1903, was for properly caring for the Government plant used in the construction of the jetties in past years.

The maximum draft that could ordinarily be carried during the fiscal year ending June 30, 1903, at mean low tide over the shoalest part of the locality under improvement was about 13 feet. The average range of the tide is 5.9 feet. Small steamboats can navigate Yaquina Bay and river to the head of tide, about 24 miles from its mouth in the ocean.

For extended information, see Annual Report of the Chief of Engi-

neers for 1893, part 4, page 3314, and House Document No. 110, Fifty-sixth Congress, first session.

Comparative statement of traffic.

Year.	Tons.	Year.	Tons.
1882	1, 830	1898	24, 767
1883	1, 359	1894	23, 345
1884	4, 995	1895	24, 589
1885	9, 951	1896	17, 883
1886	6, 249	1897	15, 364
1887	24, 694	1898	10, 380
1888	23, 431	1899	5, 990
1889	32, 921	1900	691
1890	40, 074	1901	576
1891	27, 540	1902	1, 152
1892	27, 111		

NOTE.—The statistics for 1882-1894 are for the fiscal years ending June 30; for 1895-1902 they are for calendar years.

July 1, 1902, balance unexpended	\$4, 926. 62
June 30, 1903, amount expended during fiscal year	854. 64

July 1, 1903, balance unexpended	4, 071. 98
July 1, 1903, outstanding liabilities	4. 50

July 1, 1903, balance available	4, 067. 48
---------------------------------------	------------

(See Appendix W W 5.)

6. *Tillamook Bay and bar, Oregon.*—Tillamook Bay is an indentation of the Oregon coast, about 6 miles long by about 3 miles wide, and lies about 50 miles south of the mouth of the Columbia River. The usual bar exists in the ocean at the entrance to the bay, but generally has about 14 feet of water over it at mean low tide. At low tide the bay inside is a succession of sand and mud flats, separated by four channels, which latter shoal to a low-tide depth of but 1 or 2 feet near the east end of the bay. Coasting vessels drawing about 14 feet reach Hobsonville, a short distance inside the entrance.

Tillamook is on Hoquarten Slough, about 12 miles from the entrance to the bay, and is the distributing point for a very fertile valley lying between the Pacific Ocean and the Coast Range of mountains.

The original project for the improvement of Tillamook Bay was approved by the War Department October 4, 1888, and provided for a survey of the entrance and the improvement of Dry Stocking bar by building pile dikes. The estimated cost was \$5,200.

The expenditures on the original project prior to operations under existing project amounted to \$5,700.

The existing project provided for connecting the north and middle channels nearly opposite Bay City, putting in dikes at Junction and Dry Stocking bars, and aimed to obtain a least depth in the channel of 9 feet at mean high tide from Hobsonville up to Tillamook, at an estimated cost of \$100,000.

The amount expended on the work of existing project up to the close of the fiscal year ending June 30, 1903, is \$81,541.53, of which the sum of \$13,768.16 was for maintenance of improvement.

The maximum draft that can be carried June 30, 1903, at mean low tide over the shoalest parts of the locality under improvement is between 3 and 4 feet.

The mean range of tide is 6.3 feet.

While a channel of the projected depth has been obtained between Hobsonville and Tillamook, it will be necessary, in order to maintain it in good condition, to do some dredging on the shoals and at very crooked places in Hoquarten Slough, and to repair and strengthen the existing dikes by the addition to them of brush and stone. The available funds now on hand are being used in this direction.

The act of Congress of June 13, 1902, in making an appropriation for completing this work and maintaining the improvement, directed that a survey of the ocean bar be made with a view of making estimates of the cost of securing channels across it of 15 and 20 feet depth, respectively.

This survey was made in September and October, 1902, and report thereon is herewith as Appendix W W 13.

There is considerable timber in the vicinity of Tillamook Bay, as well as fertile valley lands. The lumber is marketed almost exclusively in San Francisco, and the agricultural products are marketed in both San Francisco and Portland. The products are transported from Tillamook Bay to San Francisco and Portland by coasting vessels. There being no railroad in the vicinity at this time, the country is dependent upon the bay and ocean for transporting the products to market.

For further descriptive details, reference is invited to Annual Report of the Chief of Engineers for 1892, pages 2742-2752.

Comparative statement of traffic.

Year.	Tons.	Year.	Tons.
1889	3,571	1897	29,406
1890	27,427	1898	35,886
1891	28,292	1899	36,835
1892	33,220	1900	17,640
1893	18,316	1901	21,147
1895	29,742	1902	24,883
1896	25,977		

NOTE.—The statistics for years prior to 1896 are for fiscal years ending June 30; since 1896 they are for calendar years.

July 1, 1902, balance unexpended	\$27,081.39
June 30, 1903, amount expended during fiscal year	8,618.24

July 1, 1903, balance unexpended	18,463.15
July 1, 1903, outstanding liabilities	800.00

July 1, 1903, balance available	17,654.15
---------------------------------------	-----------

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	10,000.00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W W 6.)

7. *Upper Columbia and Snake rivers, Oregon and Washington.*—The designation "upper Columbia and Snake rivers, Oregon and Washington," now covers the 125 miles of the Columbia River from Celilo, Oreg., up to the mouth of Snake River at Ainsworth, Washington, and the 221 miles of the Snake River from its mouth up to Pittsburg Landing, Oregon.

Both the Columbia and Snake rivers, between Celilo and Asotin, a small settlement about 5 miles above Lewiston, and the limit of regular navigation in the past, are more or less obstructed by rock and gravel bars, which cause rapids, the controlling depth over some of which at low water is from 2 to 3 feet, while some (particularly in the 67 miles of the Snake, between its mouth and Riparia, Wash.) are impassable at extreme low-water stages.

The Snake River, between Asotin and Pittsburg Landing, 76 miles, falls about 7 feet to the mile at low-water stage. The channel in some places is narrow and crooked and is obstructed by many rapids and rocks. A small, powerful, and light-draft steamboat has just been completed at Lewiston for the Eureka Mining, Smelting and Power Company, to run between Lewiston and the mouth of the Imnaha River, 52 miles above, to furnish transportation for copper mines being developed by it at the latter place.

No formal project for improving the two streams between Celilo and Pittsburg Landing has ever been adopted by Congress. The first appropriation for the upper Columbia was made by act of June 10, 1872.

The Snake River has been surveyed between its mouth and the mouth of the Imnaha River, that portion above Lewiston being made in October, 1902, but a continuous survey of the Columbia between Celilo and the mouth of the Snake has never been authorized or made.

Owing to the construction of railroads along and adjacent to both streams and the difficulties of navigating the Snake River below Riparia and some portions of the Columbia between Celilo and the mouth of the Snake, steamboats abandoned the stream between Celilo and Riparia for purposes of regular navigation about 1882.

The expenditures to June 30, 1903, \$293,321.69, resulted in removing some of the worst obstructions to steamboat navigation between Celilo and Asotin and in the construction of several dikes to deflect and concentrate the flow over shoals.

The expenditures during the fiscal year ending June 30, 1903, were for properly caring for the Government plant used in the work of improvement in past years, and in making a survey of the river between Lewiston and the mouth of Imnaha River and the blasting out of a few rocks in the channel between those places.

The existing project, approved by Congress by act of June 13, 1902, provides for completing and maintaining the improvement of the Snake River between Riparia and Lewiston and for the improvement of the Snake River between Lewiston and Pittsburg Landing.

The estimated cost of the project of improvement between Riparia and Lewiston is \$23,000, with \$5,000 additional for maintenance for two years.

No estimate or detailed project had ever been made for the improvement of the Snake above Lewiston before Congress, by act of June 13, 1902, appropriated \$25,000 for the improvement between Lewiston and Pittsburg Landing.

A project for improvement between Lewiston and the mouth of the Imnaha which was based on survey made in October, 1902, was submitted on April 22. This project was approved by the Secretary of War on May 29, 1903. Estimated cost, \$33,690. The report is printed herewith in Appendix W W 14. The approved project for the Snake, therefore, now includes the river between Riparia and Imnaha River, and

also provides for the construction of a dredge to be paid for from available funds, the survey between Imnaha River and Pittsburg Landing being deferred until further appropriations are made.

No expenditures have yet been made under the existing project, except for the survey above mentioned and for blasting out a few of the obstructing rocks and for preparing plans for a self-propelling dredge for work both below and above Lewiston.

The maximum draft that could be carried at mean low water during the fiscal year ending June 30, 1903, over the shoalest point in Snake River between Riparia and Lewiston (the limits of regular navigation) was about 4½ feet. The river is subject to very high rises, varying from 18 to 26 feet, commencing early in May and lasting until September; there is also usually an autumn rise in November, varying from 4 to 10 feet.

For information in detail concerning the immense territory drained by and tributary to the Columbia and Snake rivers, the commerce of the country, and the present means for transporting it, attention is particularly invited to House Document No. 228, Fifty-sixth Congress, second session (printed also in Annual Report of the Chief of Engineers for 1901, pp. 3501-3525).

A report of an examination between Asotin and Pittsburg Landing is printed in House Document No. 75, Fifty-sixth Congress, first session. For project between Lewiston and Riparia, see House Document No. 127, Fifty-sixth Congress, second session.

Comparative statement of traffic.

Year.	Tons.	Year.	Tons.
1875	18, 230	1896	25, 977
1879	65, 975	1897	31, 531
1884	30, 260	1898	36, 923
1881	31, 400	1899	45, 654
1882	19, 167	1900	53, 920
1883	19, 364	1901	36, 723
1884	9, 902	1902	37, 824
1896	37, 100		

The above statistics since 1896 are for the calendar years; for years prior to 1896 they are for fiscal years ending June 30. Statistics for years not named are not available.

July 1, 1902, balance unexpended	\$52, 544. 41
June 30, 1903, amount expended during fiscal year	3, 998. 99

July 1, 1903, balance unexpended	48, 545. 42
--	-------------

(Amount (estimated) required for completion of existing project	Indefinite.
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903	10, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix W W 7.)

8. *Columbia River at Three-mile Rapids, Oregon and Washington.*—The object of this improvement is to overcome the obstructions in the 12 miles of the Columbia River between the foot of The Dalles Rapids

and the head of Celilo Falls. In this stretch of river there is Three-mile Rapids, a crooked channel, 1,500 feet in length, narrow and much obstructed by rocks and currents; then Five-mile Rapids (The Dalles), where for $1\frac{1}{4}$ miles the river rushes with great velocity between precipitous walls of basalt 150 to 300 feet apart; next comes Ten-mile Rapids, a similar gorge, but only one-half mile in length, and last of all Celilo Falls, with a sheer fall of 20 feet. In this 12 miles of river the total fall is about 80 feet in low water and in high stages 60 feet.

Extended information as to general availability for purposes of commerce and extent of territory to be benefited by the improvement is given in previous reports.

The original project for this improvement was made pursuant to the act of August 11, 1888. The plan recommended was for a boat railway for the transshipment of boats with cargo weighing 600 tons. Estimated cost, \$2,860,356.35.

Again, in 1892, the act of July 13 authorized the appointment of a Board to examine the locality and report such plan for overcoming and removing the obstructions as in their opinion was most feasible and best adapted to the wants of navigation. A majority of the members of this Board were in favor of a canal. Two members preferred a boat railway, at an estimated cost of \$2,264,467, including \$170,000 for improving Three-mile Rapids. The latter project was adopted by act of August 18, 1894, and \$100,000 was appropriated for the purchase of right of way, preparation of plans, etc.

The work done on this project consisted of acquiring title to part of the land for right of way, in partially preparing the necessary plans for the boat railway, and in making a survey of the river between The Dalles and Celilo, with a view to overcoming the obstructions by means of canals and locks, this latter survey having been authorized by act approved June 6, 1900. The report of the above survey recommended the construction of a canal and locks, and the act of June 13, 1902, approved the construction of the canal and locks, and at the same time authorized the unexpended balance, theretofore appropriated for obtaining the necessary right of way and commencing the construction of a boat railway, to be used for the canal. The estimated cost was \$3,969,371. The act also provided that before entering upon the work an examination be made by a Board of Engineers with a view to modifying the project in such a way as to diminish the cost thereof.

The Board of Engineers appointed by paragraph 6, Special Orders No. 19, headquarters, Corps of Engineers, July 5, 1902, as required by the act just mentioned, held their first meeting in Portland, Oreg., in September, 1902, and after visiting the site of the works requested certain additional information and estimates to be made. At its second meeting in Portland, Oreg., May 11 to 14, 1903, after a consideration of the additional data and estimates, it requested that a detailed survey be made of the ground for a continuous canal on the Oregon side extending from above Celilo Falls to below Five-mile Rapids, drawing its water supply from the river above Celilo Falls. The work of this survey is now in progress. It is expected that the Board's report will be submitted to Congress at its next session.

The expenditures on this work to June 30, 1902, amounted to \$35,568.49, less \$7,500 refunded by the United States Circuit Court on account of condemnation proceedings in case of *United States v. Seufert Brothers Company*, and \$1,030.66 since returned to the appropriation

by the Oregon Railroad and Navigation Company on account of the relinquishment by the United States of rights of way not needed for the canal and locks.

The amount expended up to the close of the fiscal year ending June 30, 1903, less the amounts refunded as above, was \$41,506.98.

The expenditures during the fiscal year were in connection with surveys at Five-mile and Ten-mile rapids, gauging the flow of the Columbia River, and making the various estimates for above-mentioned Board of Engineers.

For extended information, attention is invited to the following references:

For project of 1888, see House Document No. 64, Fifty-first Congress, first session.

For project adopted in 1894, see Annual Report of the Chief of Engineers for 1894, page 2664 et seq.

For project adopted in 1902, see Annual Report of the Chief of Engineers for 1901, page 3501 et seq.

July 1, 1902, balance unexpended	\$214,431.51
May 21, 1903, deposited, account refundment United States court.....	7,500.00
July 6, 1903, deposited, account refundment for right of way.....	1,030.66
June 30, 1903, amount expended during fiscal year.....	222,962.17
	14,469.15
July 1, 1903, balance unexpended	208,493.02
July 1, 1903, outstanding liabilities	218.00
July 1, 1903, balance available	208,275.02

{ Amount (estimated) required for completion of existing project	Indefinite.
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	\$300,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W W 8.)

9. *Canal at the Cascades, Columbia River, Oregon.*—In passing through the Cascade Mountain Range the channel of the Columbia River, for the distance of about $4\frac{1}{2}$ miles, is so contracted in width that that portion of the stream partakes of the nature of a gorge. In the upper 2,500 feet of this gorge there is a fall of about 24 feet at low water, which, on account of the rapids and huge bowlders, can not be navigated. Throughout the lower portion of the gorge, about 4 miles, the channel, while not as contracted nor of as steep slope as the upper 2,500 feet, was nevertheless so contracted and of such slope that rapids were formed that could not be navigated at the higher stages. This lower portion of the gorge, also, was originally much obstructed by large bowlders and reefs.

The original project was for canal and locks, at an estimated cost of \$2,544,545, and was approved by the Secretary of War on October 12, 1877, and modified by a Board of Engineers in 1886 and 1888 to include the improvement of the rapids below the falls to secure a low-water channel of 8 feet, with a lock 462 feet long and 90 feet wide. The

^a Of this amount \$100,000 is for continuing-contract work authorized by the river and harbor act approved June 13, 1902.

project was again modified in 1894 to provide for utilizing the 462 feet of the incomplete canal above the upper lock gates as a second lock. It also provided for raising the protection work of the canal, the height of which has been based on the flood of 1876, the highest water known previous to 1894, in order to make the height of walls conform to the flood level of the latter year, which was 6 feet above that of 1876. The estimated cost of this modification (\$413,360 additional) was approved by act of June 3, 1896, and \$50,000 was appropriated therefor.

The work of constructing the locks has been prosecuted since the adoption of the original project, both by hired labor and by purchase of materials, and under contract, until the walls and slopes were partially completed and the locks opened to navigation in the fall of 1896, at which time the work was under contract with the Cascades Construction Company.

The amount expended on original modified project up to the close of the fiscal year ending June 30, 1903, was \$3,773,187.80.

There has been a total of \$3,778,000 appropriated for this work. The amount estimated as required to complete the walls and place the grounds in good condition was \$229,260, thus making the estimated total cost \$4,007,260.

The maximum draft that can be carried through the locks at the close of the fiscal year is about 7 feet.

The yearly rise in the Columbia takes place in May, June, or July, and its usual height above extreme low water is about 40 feet.

The expenditures during the fiscal year have been under contract with Hosea W. Taylor, and the work consisted in completion of the north wall, the masonry stairway leading from the lock wall to the upper gate wall, raising the embankment separating the canal from the river, and finishing the slope pavement near the upper guard gate, thus completing all the projected work on the north side of the canal. A supplementary pipe line was also laid for additional water supply for operating the gate valve engines.

The act of June 13, 1902, made provision for the removal of some of the obstructing rocks in the rapids. Proposals for doing this work were invited, but on account of the excessive price no bid was accepted.

For further details of project and modifications attention is invited to the following references:

Original condition, Annual Report Chief of Engineers for 1884, page 2246.

Original project, Annual Report Chief of Engineers for 1889, pages 2551-2559.

Modified project of 1894, Annual Report Chief of Engineers for 1895, pages 3571-3582.

The following is a comparative statement of the commerce passing through the locks:

Year.	Freight.	Passen- gers.	Year.	Freight.	Passen- gers.
	<i>Tons.</i>	<i>Number.</i>		<i>Tons.</i>	<i>Number.</i>
1898.....	18, 812	30, 327	1901.....	22, 426	34, 762
1899.....	16, 700	23, 908	1902.....	19, 710	62, 720
1900.....	17, 710	30, 639	1903.....	36, 181	60, 821

NOTE.—The above statistics are for fiscal years ending June 30.

July 1, 1902, balance unexpended	\$31, 934. 58
Proceeds of sales of public property, January 5, 1903	6, 100. 00
	38, 034. 58
June 30, 1903, amount expended during fiscal year	27, 122. 38
July 1, 1903, balance unexpended	10, 912. 20
{ Amount (estimated) required for completion of existing project	229, 260. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	80, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix W W 9.)

10. *Operating and care of canal and locks at the Cascades of the Columbia River, Oregon.*—The obstructions in the Columbia River at the Cascades are described in the preceding report. The canal and locks, which pass steamboats around these obstructions, were opened to navigation on November 5, 1896, although incomplete in many details, and have been in condition to be used ever since that date, with the exception of a few days when minor repairs were in progress, and a few days in June, 1903, when the water was too high.

The expenditures up to June 30, 1902, \$35,263.50, were in payment of salaries of employees engaged in operating and caring for the canal and locks, for partially repainting the steel lock gates, and for dredging deposit from the upper entrance to the canal, under a contract dated October 9, 1901.

The expenditures during the fiscal year ending June 30, 1903, amounting to \$6,840.31, were in payment of salaries of employees engaged in operating and caring for the canal and locks, in continuing the work of repainting the steel lock gates, and in dredging deposit from the lower and upper entrances to the canal under a contract dated October 9, 1901, which contract was completed December 1, 1902.

(See Appendix W W 10.)

11. *Columbia River, between Vancouver, Wash., and the mouth of Willamette River.*—The city of Vancouver, Wash., is located on the Columbia River about 103 miles above its mouth and 5 miles above the junction of the Willamette and Columbia rivers. Vessels drawing up to 23 feet ascend the Columbia from its mouth up to a point 2½ miles below the town of Vancouver, where there is a bar which had originally but 9 feet of water over it at lowest river stage. Steamboats drawing about 8 feet can navigate the river as far as The Dalles by passing through the Cascade locks.

The project adopted in 1892 provided for constructing a pile, brush and rubblestone dike about 3,000 feet long, from the Oregon shore to the head of Hayden Island, opposite Vancouver, at an estimated cost of \$100,000, to stop the flow south of the island during low-water stages and deflect it down the main channel north of the island, so as to scour the bar below Vancouver and obtain a depth over it sufficient to permit ascending vessels drawing 20 or more feet to reach Vancouver. It was approved by the Chief of Engineers August 6, 1892.

On June 18, 1901, the additional sum of \$8,000 was allotted from the appropriation of June 6, 1900, for emergencies in river and harbor works, to be applied to repairing the dike during the low-water period of the winter of 1901-2.

The expenditures to June 30, 1903, were \$109,366.99, of which the sum of \$23,833.83 was for maintenance, and resulted in completing the dike and in revetting the head of Hayden Island to prevent erosion. The map following page 3230 of the Annual Report of the Chief of Engineers for 1899 shows the work as completed May 2, 1899.

The expenditures made during the fiscal year ending June 30, 1903, amounting to \$1,603.65, were for maintenance of the improvement, 635 cubic yards of rubblestone being placed in the main dike at several places to compensate for settlement caused by the summer high water of 1902. The stone was purchased and placed in the dike under an emergency contract dated November 12, 1902. No soundings have been made on the bar below Vancouver during the year, but masters of steamboats report a slight increase in depth.

The maximum draft that could be carried at extreme low water during the past year was about 10 feet.

The average range of tide in the Columbia River at Vancouver at extreme low stage is about 0.8 foot. During the summer freshet, which generally occurs in June, the usual rise is about 20 feet.

For further information reference is invited to Annual Report of the Chief of Engineers for 1896, pages 3264-3265.

Report of the examination and survey authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

July 1, 1902, balance unexpended	\$2, 237. 66
June 30, 1903, amount expended during fiscal year	1, 603. 65

July 1, 1903, balance unexpended	634. 01
--	---------

{	Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	10, 000. 00
	Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	(See Appendix W W 11.)	

IMPROVEMENT OF WILLAMETTE RIVER, AND OF COLUMBIA RIVER BELOW THE MOUTH OF THE WILLAMETTE, AND THEIR TRIBUTARIES, OREGON AND WASHINGTON.

This district was in the charge of Maj. W. C. Langfitt, Corps of Engineers. Division Engineer, Lieut. Col. W. H. Heuer, Corps of Engineers.

1. Willamette River above Portland, and Yamhill and Long Tom rivers, Oregon.—The Willamette River rises in the Cascade Range, about 150 miles southward of the Columbia River, and flows northerly, generally parallel to and about 50 miles east of the coast line. It enters the Columbia about 105 miles above its mouth and 12 miles north of the city of Portland.

The Yamhill River rises in the Coast Range, flows in a northeasterly direction, and enters the Willamette about 40 miles above its mouth.

The Long Tom River is also a tributary of the Willamette. It rises on the eastern slope of the Coast Range, drains an area of about 430 square miles, including a large amount of very productive valley land, and empties into the Willamette River 122 miles distant from Portland by river.

A detailed description of the Willamette River, together with that of its condition prior to improvement, may be found in the Annual Report of the Chief of Engineers for 1876, page 654, and for 1880, page 2280.

The Willamette River drains an exceedingly fertile valley, which has been settled for years. Prior to improvement the channel was obstructed by snags and rocks, which were removed under the project of 1892 to enable boats to reach Dayton, on the Yamhill River, about 5 miles above its mouth, at all seasons on a draft of about $2\frac{1}{2}$ feet. Above Dayton and about 1 mile below Lafayette the channel of the Yamhill was obstructed by rapids, so that boats could reach Lafayette, 9 miles, and McMinnville, about 18 miles above its mouth, only during extreme high water.

The original project for improvement of the Willamette was adopted in 1870 and modified in 1878 and 1879, and in 1892 was extended to include the removal of obstructions in the Yamhill River to McMinnville.

On the above project \$247,747.51 has been expended.

The project of 1896 provided for the improvement of the Willamette River from Portland to Eugene, at an estimated cost of \$131,697, and on the Yamhill (see Annual Report of the Chief of Engineers for 1895, p. 3602) provided for the removal of obstructions and the construction of a lock and dam in the Yamhill River to obtain a draft of $3\frac{1}{2}$ feet from the mouth of the river to McMinnville. Estimated cost, \$69,000. On the project of 1896 there was expended up to June 30, 1902, the sum of \$202,620.69, of which amount \$5,421.22 was applied to maintenance.

The construction of controlling works under the old project has without doubt afforded relief and alone made navigation possible during recent years. However, it is believed that the physical features of the river are such that the depths proposed by the project can not be obtained at reasonable cost.

The river and harbor act of June 13, 1902, appropriated \$68,000 for continuing improvement, and allows \$500, or so much thereof as may be required, for maintenance of improvement of Long Tom River. It is proposed to apply these funds to the construction of a dredging plant to aid in creating and maintaining such depths as may be reasonable and practicable, snagging, and the construction of controlling works at places where they will be of greatest benefit. This is practically a continuation of previous operations, with the addition of a dredging plant to aid the work below Corvallis, and confining operations above Corvallis to snagging for aid to high-water navigation.

The project for improving Long Tom River was adopted by act of March 3, 1899. The river is of very small volume, and runs so low during the spring and summer that navigation is impossible. The improvement was intended to furnish navigation only during seasons of freshets. The amount appropriated was transferred from the improvement for Willamette and Yamhill rivers, and amounted to \$3,000, all of which was expended and project satisfactorily completed. Although the last river and harbor act allowed \$500 for maintenance of this stream, no further work is proposed until such time as the commerce seems to demand it.

The expenditures made on the Willamette and Yamhill rivers during the fiscal year 1903 were in the nature of repairs to existing dams and revetments and construction of new dams, and in removing fallen

trees, snags, and other obstructions from the channel. The amount expended was \$32,417.77.

The total amount expended on the project of 1896 up to the close of the fiscal year ending June 30, 1903, was \$238,038.46. In this amount is included \$3,000 expended on the improvement of the Long Tom River, and it may be said that \$18,045, including expenses of operating snag boat and repairs to dams, was in maintenance.

The work resulted in leaving a practically clear channel to Corvallis, and also included quite extensive repairs to the revetment in the bend above Corvallis.

At the close of the fiscal year the snagboat was laid up and no further work was in progress except the construction of the revetment near Independence.

The water levels vary according to height of the winter freshets, which, in 1891, reached 30 feet above low water at Salem, Oreg.

The additional work proposed is for the purpose of affording better facilities for navigating the portions of river under improvement, as an extension of benefits is not contemplated.

Preliminary examinations and surveys of Willamette River between Portland and Oregon City, Oreg., and of Willamette River opposite Albany, have been made in pursuance of requirements of the river and harbor act of June 13, 1902. Reports thereon have been made and have received consideration by the Board of Engineers for Rivers and Harbors. The board recommends the preparation of a revised project for improving the Willamette above Portland, and such a project, to include the sections between Portland and Oregon City, and opposite Albany, is now being prepared by the district officer. The reports mentioned will be submitted to Congress in December, 1903, as well as report of examination of Yamhill River authorized by the same act.

The volume of commerce affected is shown by the appended comparative statement of traffic handled. This tonnage consists of grain, farm and lumber products shipped to market, and machinery and supplies distributed.

Comparative statement of traffic.

Calendar year.	Merchandise.	Passengers.	Calendar year.	Merchandise.	Passengers.
	<i>Tons.</i>	<i>Number.</i>		<i>Tons.</i>	<i>Number.</i>
1894.....	74,615	56,368	1899.....	117,782	50,738
1895.....	130,870	57,376	1900.....	182,458	47,324
1896.....	218,480	48,465	1901.....	191,901	103,971
1897.....	186,621	87,960	1902.....	192,227	96,221
1898.....	112,154	67,524			

July 1, 1902, balance unexpended	\$68,131.80
June 30, 1903, amount expended during fiscal year	32,417.77

July 1, 1903, balance unexpended	35,714.03
July 1, 1903, outstanding liabilities	22.00

July 1, 1903, balance available	35,692.03
---------------------------------------	-----------

Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	90,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix X X 1.)

2. *Operating and care of lock and dam in Yamhill River, Oregon.*—The Yamhill lock is situated on Yamhill River near Lafayette, Oreg., about 8 miles above its junction with the Willamette, and some 10 miles below the town of McMinnville, the head of steamboat navigation. The lock was completed under contract in September, 1900.

The funds for operating and care of the lock and dam during the fiscal year 1903 were provided by allotment of July 12, 1902, the amount allotted being \$27,000, the balance remaining on hand, \$1,367.33, being required for completion of the repairs, etc., authorized under previous allotment. The total amount expended under allotments for operating and care, including repairs, is \$28,860, of which amount \$4,067.33 was expended during the fiscal year 1903.

The repairs to slopes and pavements were completed in the early part of the year, since which time no work has been done except to attend to minor repairs and to operating the lock.

The total amount of traffic that passed through the lock during the year amounted to 1,747 tons of miscellaneous freight and 284 passengers, while the previous year's business was 2,455 tons of freight and 1,199 passengers. The comparatively small amount of traffic is owing to the fact that the Oregon City Transportation Company have taken their boats for use on the Willamette River and abandoned the McMinnville route because of the frequently closed lock and the small amount of traffic previously handled.

(See Appendix X X 2.)

3. *Columbia and lower Willamette rivers below Portland, Oreg.*—The Columbia River rises in British Columbia, flows southerly and westerly, and forms in its lower portion for 330 miles the boundary between Oregon and Washington, emptying into the Pacific Ocean between these two States.

The Willamette River rises in the Cascade Range, about 150 miles southward of the Columbia River, flows northerly, entering the Columbia about 100 miles above its mouth and 12 miles north of the city of Portland.

The portions of these rivers covered by this improvement include the 12 miles of the Willamette between Portland and its mouth and 98 miles of the Columbia from the mouth of the Willamette to the sea.

The original condition of these rivers from Portland to the sea was such that only from 10 to 15 feet could be carried over the shoal places at low water. Numerous sand bars obstructed navigation by deep-water craft and distributed the water over an extended area, so that the channels were comparatively narrow.

The value and the availability of this waterway for purposes of commerce is proved by the quantities of grain and produce that through it find an outlet to the markets of the world from Oregon, Washington, and Idaho. Its improvement to navigation for deep-water craft is of the utmost importance to the entire northwest section of the country, whose inhabitants find the natural outlet for their produce through the valley of the Columbia.

Prior to adoption of a project, dredging had been done for temporary relief, and the sum of \$221,780.46 expended for that purpose.

The original project was adopted in 1877 and was prepared by the Board of Engineers for the Pacific coast with a view of obtaining a channel depth of 20 feet. In 1891 the project was extended to obtain a low-water channel depth of 25 feet, at an estimated cost of \$772,464, and the Port of Portland Commission, a corporation existing under the

laws of the State of Oregon, was granted permission to assist in carrying it into execution. On the original and modified project, exclusive of amounts expended in dredging prior to 1877 and by the Port of Portland Commission, there has been expended the sum of \$1,156,785.77 to June 30, 1903, and it may be said that all the expenditures since 1895 have been applied to maintenance, as no permanent works have been constructed.

The existing project, adopted by the act of June 13, 1902, is based on survey authorized by act of March 3, 1899, and proposes a 25-foot channel to the sea by construction of controlling works and dredging. Estimated cost, \$2,796,300, with \$175,000 as cost of a new dredge and accessories and \$50,000 for maintenance.

The sum of \$225,000 was appropriated by act of June 13, 1902. This sum was insufficient to allow of the construction of a new dredge, paying operating expenses of the dredges, making necessary repairs to plant, and construction of any permanent works. In view of this, it is proposed to confine operations to dredging, and a contract for the hire of either of the dredges of the port of Portland was made and approved. Consequently, dredging at shoal places has been the only work of improvement done during the year. The dredges in use were the U. S. dredge *W. S. Ladd*, which removed 683,208 cubic yards of material, and the 30-inch suction dredge of the port of Portland, under the above-mentioned contract, which removed 993,389 cubic yards. The port of Portland operated its 20-inch suction dredge during such time as it was not being repaired; also the 30-inch dredge prior to its hire by the United States, and reports having removed 1,105,082 cubic yards.

The results have been beneficial and have reduced the delays to shipping.

The ruling depth at the end of the fiscal year between Portland and the sea is about 20 feet at low water. The increase in depth since commencement of improvement is about 6 feet, with a good navigable width of channel.

The usual variations of water level due to tide are from 2 feet at Portland to 7 feet at Astoria, and the difference in water levels on account of freshets ranges from 20 feet at Portland to zero at Astoria.

For further information as to original condition, etc., attention is invited to the following references:

Project of 1891, see Annual Report of the Chief of Engineers for 1892, page 2850 et seq.

Project of 1902, see Annual Report of the Chief of Engineers for 1900, page 4418 et seq.

Comparative statement of traffic.

Calendar year.	Handled by river craft.	Foreign and coast-wise to and from Portland.	
		Receipts.	Shipments.
	Tons.	Tons.	Tons.
1893.....	1,310,866	.....	812,790
1894.....	1,347,155	52,272	340,792
1895.....	1,040,022	40,238	395,954
1896.....	1,129,673	49,011	329,102
1897.....	1,499,337	47,346	290,412
1898.....	1,121,161	27,776	488,818
1899.....	1,489,708	36,253	336,134
1900.....	1,287,582	32,905	489,385
1901.....	1,534,780	29,548	639,736
1902.....	1,567,336	145,514	985,912

July 1, 1902, balance unexpended	\$252, 712. 19
December 3, deposit from proceeds of sale.....	46. 77
	252, 758. 96
June 30, 1903, amount expended during fiscal year	75, 911. 66
July 1, 1903, balance unexpended	176, 847. 30
July 1, 1903, outstanding liabilities.....	8, 507. 25
July 1, 1903, balance available	168, 340. 05
{ Amount (estimated) required for completion of existing project	2, 673, 509. 93
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix X X 3.)

4. *Columbia River, Oregon, below Tongue Point.*—This improvement covers a stretch of the river about 5½ miles long, beginning just below Tongue Point and extending down along the water front of Astoria. The principal obstruction is a rocky point known as the Sylvia de Grasse reef, about 1 mile below Tongue Point, and around which ships are obliged to make a short turn to avoid striking it.

The original and present project, adopted in 1896, contemplated the removal of the wreck of the *Sylvia de Grasse* and the outer portion of the reef, supplemented by dredging to obtain a 25-foot channel, 250 feet in width, extending along the water front of Astoria. Estimated cost, \$121,550.

The amount expended on this work up to the close of the fiscal year ending June 30, 1903, was \$95,650.59. Prior to operations under the present project, no work had been done except dredging for temporary relief.

Work on the contract with E. T. Johnson, dated October 20, 1900, was continued up to October, 1902, at which time the contract was completed. Since that date no work has been done.

The outer portion of the reef has been removed to a depth of 25 feet at mean lower low water and a part of the dredging done.

A report of the project will be found in the Annual Report of the Chief of Engineers for 1895, pages 3605 to 3608.

The usual variation of tide at this locality is 6½ to 7 feet.

For commercial statistics, see report on "Improving Columbia and lower Willamette rivers below Portland, Oreg."

July 1, 1902, balance unexpended.....	\$49, 894. 14
June 30, 1903, amount expended during fiscal year.....	24, 544. 73

July 1, 1903, balance unexpended.....	25, 349. 41
---------------------------------------	-------------

(See Appendix X X 4.)

5. *Mouth of Columbia River, Oregon and Washington.*—Prior to commencing the work of construction, in 1885, there were from one to three channels across the bar at the mouth of Columbia River, and these channels varied both in location and depth, the latter being usually from 19 to 21 feet, while the location shifted through nearly 180 degrees from Cape Disappointment to Point Adams.

The project for improvement, adopted in 1884, contemplated securing a low-water channel depth of 30 feet across the bar at the mouth of the river by the construction of a jetty to extend from the shore near

Fort Stevens across Clatsop Spit in the direction of a point about 3 miles south of Cape Disappointment, the jetty to be built of rubble and random blocks of large size, resting upon mattresses of brush.

The original project, adopted in 1884, provided for a single jetty on the south side of the entrance, built to low-water level and about $4\frac{1}{2}$ miles long. This was modified in 1893 to provide for practically a high-tide jetty, in which was included the construction of four low groins built out from the main jetty. The estimated cost of the jetty in the original project was \$3,710,000.

The jetty was completed in 1895 to the length of $4\frac{1}{2}$ miles and full projected height, with four low-tide groins—1,000 feet, 1,000 feet, 600 feet, and 500 feet long, respectively. This work caused an increase in depth over the bar from 20 to 31 feet at mean lower low water from 1885 to 1895.

Annual surveys since 1896 have shown each year marked shoaling of the depths over the bar, the greatest depth obtained having been 31 feet in 1895, being 1 foot in excess of the depth proposed by the original project.

A survey was made and detailed project, with estimate, was submitted in 1899. Estimated cost, \$2,531,140.51. This project consisted in an extension of 3 miles to the jetty previously constructed.

Funds were made available as follows: By act of June 6, 1900, \$250,000; act of June 13, 1902, \$500,000, with not to exceed expenditure of \$1,000,000 under contract, and repairs to plant and tramway were authorized pending a report and recommendation of a Board of Engineers. The Board made its report under date of January 24, 1903, and the sundry civil act of March 3, 1903, made an additional appropriation of \$1,000,000 for the work.

This project of the Board, approved by the Secretary of War on March 16, 1903, is but a slight modification of the project of 1899, and provides for extension of the present jetty. Dredging is also recommended as a temporary expedient to give early relief, and the thought is also expressed that the construction of a north jetty may be necessary at some future time to secure the desired depth of 40 feet with a practicable width of channel. The estimated cost of south jetty is \$2,260,000; of remodeling and operating dredge, \$250,000; total, \$2,510,000. The report of the Board is submitted herewith in Appendix X X 5.

The amount expended on old project was \$1,968,753.14, and on the present project, including repairs under project of 1899 to the end of fiscal year 1903, was \$439,565.33.

Since the funds became available, the work accomplished has been the redriving of the old tramway, assembling materials and plant preparatory to extension of the jetty, contracts were made for a greater portion of the material and an emergency contract, and one formal contract was made with the Northwest Construction Company, of Astoria, Oreg., for furnishing the rock. At the close of the year delivery of rock under the emergency contract had been commenced. The transport *Grant* has been transferred to the Engineer Department, and is being fitted up at San Francisco as a dredge for deepening the channel, and was about 82 per cent completed at the close of the year. For further details see Appendix I 6. The acquisition of a dredge and its operation will require, it is estimated, \$500,000, which will reduce the funds available for jetty construction by this amount, and this should be con-

sidered in making further appropriations. In order that there may be no cessation in this important work, the balance needed to complete the south jetty should be appropriated at once.

This year's survey differs but little from the survey of 1902. The depth of the north channel has decreased about 1 foot, while that of the south channel has increased a corresponding amount, thus making the navigable depth in the north and south channels, at the average of the lower low waters, 20 and 21 feet, respectively. There are, however, narrow channels of 21 and 23 feet, respectively.

This improvement is to furnish easy passage of deep-sea vessels over the bar, the head of deep-sea navigation being at Portland, Oreg., about 110 miles above the mouth. The average rise and fall of tide is about 7.4 feet.

For further detailed information attention is invited to the following references: Map of locality before improvement, Annual Report of the Chief of Engineers for 1886, page 1978; project of 1884, report of Board of Engineers, Annual Report of the Chief of Engineers for 1883, page 2012 et seq.; modified project of 1893, Annual Report of the Chief of Engineers for 1893, page 3489 et seq.; map of completed project of 1884-1893, Annual Report of the Chief of Engineers for 1895, page 3560; survey and project, House Document No. 94, Fifty-sixth Congress, first session; latest approved project, report of the Board of Engineers dated January 24, 1903, in Appendix X X 5 of this report.

For commercial statistics, see report on "Improving Columbia and lower Willamette rivers below Portland, Oreg."

July 1, 1902, balance unexpended	\$523, 454. 39
Amount appropriated by sundry civil act approved March 3, 1903	1, 000, 000. 00
Amount deposited December 3, account proceeds of sale	56. 31
June 30, 1903, amount expended during fiscal year	1, 523, 510. 70
	^a 206, 090. 86
July 1, 1903, balance unexpended	1, 317, 419. 84
July 1, 1903, outstanding liabilities	^b 24, 454. 81
July 1, 1903, balance available	1, 292, 965. 03
July 1, 1903, amount covered by uncompleted contracts.....	^c 586, 040. 95
{ Amount (estimated) required for completion of existing project	776, 181. 46
{ Amount that can be profitably expended in fiscal year ending June 30,	
{ 1905, in addition to the balance available July 1, 1903	500, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June	
{ 4, 1897.	

(See Appendix X X 5.)

6. *Clatskanie River, Oregon.*—The Clatskanie River rises in the Coast Range and is a tributary of the Columbia, which it enters by means of connecting sloughs at a point on the south bank, about 65 miles below Portland.

At the time of the adoption of the present original project a depth of 5 feet could be carried to Clatskanie, except over a shoal near the latter place where but 2 to 3 feet was found. Large quantities of lum-

^a Includes \$116,425.27 on account of construction of dredge.

^b Includes \$2,748.41 on account of construction of dredge.

^c Includes \$10,514.95 on account of construction of dredge.

ber and shingles find a market through this natural outlet. The channel is very narrow and exceedingly winding.

The river and harbor act of March 3, 1899, appropriated \$13,000, being the total estimated cost of completing the improvement. The project submitted for its expenditure, and approved by the Secretary of War May 27, 1899, provided for cutting a short channel across the bend immediately below Manzanillo, and another from the bend above this point to the first bend below the town of Clatskanie, and by dredging below the latter point, the work to be done by contract. It was expected to secure thereby a depth of 6 feet to the town of Clatskanie, 3 miles from the mouth.

The amount expended on this work up to the close of the fiscal year ending June 30, 1903, was \$11,343.94, none of which was applied to maintenance. The project was completed in February, 1902, under contract dated June 28, 1901.

No work was done during the fiscal year 1903, the expenditures being in part payment for dredge and repairs to same.

The completion of the project affords better facilities for navigation to the town of Clatskanie by shortening the distance and avoiding the large bend in the old channel, and by an increased depth of about 2 feet.

The maximum draft that can be carried over the shoalest place at low water to the town of Clatskanie is 5 feet. The usual variation of levels of water surface is about 5 feet due to tides and about 10 feet during freshets.

The head of navigation is the town of Clatskanie, about 3 miles from the mouth.

For further details of project, see Annual Report of the Chief of Engineers for 1898, page 3050.

Comparative statement of traffic.

Calendar year.	Merchandise.	Passengers.	Calendar year.	Merchandise.	Passengers.
	Tons.	Number.		Tons.	Number.
1896.....	117,242	8,460	1900.....	88,622	5,305
1897.....	112,803	11,545	1901.....	51,967	2,136
1898.....	153,257	12,250	1902.....	23,790	1,180
1899.....	68,126	5,210			

July 1, 1902, balance unexpended \$3,081.98

June 30, 1903, amount expended during fiscal year 1,425.92

July 1, 1903, balance unexpended 1,656.06

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903..... 500.00

{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix X X 6.)

7. *Cowlitz and Lewis rivers, Washington.*—(a) *Cowlitz River.*—The Cowlitz River rises in the Cascade Range, and flows into the Columbia River about 64 miles from its mouth.

Prior to improvement the ruling depth at low water to Toledo, 40 miles above the mouth, was 14 inches. The channel was narrow and tortuous and obstructed by sand bars, numerous snags, drift, logs, etc. The valley is exceedingly fertile, and any improvement of the river is

a direct benefit to the farmers, who ship great quantities of produce to market by boat.

The original project, adopted in 1880 (report dated December 15, 1879), contemplated the removal of sand bars and other obstructions to a point about 50 miles above the mouth, at a cost of \$5,000 for the first year and an annual expenditure thereafter of \$2,000 for maintenance.

The amount expended on the work up to the close of the fiscal year 1903 was \$32,458.34, at which time the available funds had become exhausted.

The conditions are now such that boats ascend to Toledo, the principal difficulty experienced being at the bar below Toledo, where lining over this shoal becomes necessary at low water. Three or four bars below this point are also giving trouble.

No results in the way of increased depths since last report have been attained, as no work was done during the fiscal year 1903.

In connection with this improvement it is thought that dredging in the lower tidal reaches will prove advantageous in securing and maintaining depths, and during the fiscal year a dredge has been purchased.

The maximum draft that can be carried over the shoalest part at low water is about 16 inches. The usual range of water level due to tides varies from 4 feet at the mouth to zero about 9 miles upstream. The variations due to freshets in the Cowlitz River are about 22 feet.

The head of navigation for light-draft boats on higher stages is about 10 miles above Toledo, or 50 miles from the mouth.

Comparative statement of traffic.

Calendar year.	Tons.	Calendar year.	Tons.
1894.....	17,923	1899.....	26,511
1895.....	17,940	1900.....	17,279
1896.....	14,776	1901.....	14,211
1897.....	17,582	1902.....	15,982
1898.....	16,210		

This statement does not include large quantities of logs that are annually floated down this stream.

(b) *Lewis River*.—The Lewis River rises in the Cascade Range. It is a tributary of the Columbia, drains an exceedingly fertile valley, and enters the Columbia from the north about 14 miles below the mouth of the Willamette, or 25 miles from Portland, Oreg.

At the time of the adoption of the present and original project, 4 feet could be carried at low water to the forks, $3\frac{1}{2}$ miles from the mouth, and 2 feet to Lacenter, on the East Fork, and about 7 miles from the mouth. The channel was obstructed by trees, snags, and occasional shoals. Its improvement is of benefit to the farmers and the large adjacent lumbering interests.

The project for improvement of the Lewis River contemplated the removal of snags and obstructions, dike and dam work, and dredging, with a view of obtaining a depth of 6 feet in the main river to the forks and 4 feet thence to Lacenter. Estimated cost, \$20,460.

The amount expended on the work up to the close of the fiscal year ending June 30, 1903, was \$12,479.07, none of which was applied to maintenance.

The work during the year consisted of dredging and snagging. A

dredge was purchased and started work in February, was laid up for repairs during March, and then worked until stopped by high water in May. The channel of both the East and North Fork was cleared of snags. The dredged channel of the East Fork was increased from an average of 3 feet to an average of 6 feet for a width of 50 to 100 feet. The results have been satisfactory and beneficial.

The maximum draft that could be carried on June 30, 1903, is as follows:

Mouth to forks, 4 feet; East Fork to flume above Kinder rock, 6 feet; above the flume there is practically no depth; North Fork to Woodland, 1 foot.

The head of navigation on the different portions at mean low tide is as follows:

East Fork navigable to flume above Kinder Rock, North Fork navigable to Woodland.

The usual variations of the level of water surfaces on account of tides is about 2 feet at the mouth to $1\frac{1}{2}$ feet at the Lacenter. The freshets vary from 15 to 20 feet in height.

For further details of project see Annual Report of the Chief of Engineers for 1897, page 3475.

Comparative statement of traffic.

Calendar year.	Merchan- disc.	Passen- gers.	Calendar year.	Merchan- disc.	Passen- gers.
	<i>Tons.</i>	<i>Number.</i>		<i>Tons.</i>	<i>Number.</i>
1896.....	2,374	12,990	1900.....	12,638	14,129
1897.....	3,881	15,306	1901.....	17,277	15,532
1898.....	6,303	15,938	1902.....	13,831	13,098
1899.....	6,549	12,351			

The above does not include large quantities of logs which are annually floated out of this stream.

July 1, 1902, balance unexpended	\$13,853.28
June 30, 1903, amount expended during fiscal year	8,290.69

July 1, 1903, balance unexpended.....	5,562.59
July 1, 1903, outstanding liabilities.....	98.52

July 1, 1903, balance available	5,464.07
---------------------------------------	----------

(Amount (estimated) required for completion of existing project.....	^a 5,710.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903.....	^b 7,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	—

(See Appendix X X 7.)

8. *Gauging waters of Columbia River, Oregon and Washington.*—The object of this gauging is to obtain data for use in connection with the improvement of the river and to supply information to persons interested in its navigation.

The self-registering gauge was reestablished at Astoria in November, 1888, where it was kept in operation up to August, 1899, and then

^a This is the amount required for completion of the existing project for Lewis River, and has no reference to the Cowlitz.

^b For Lewis River, including North and East forks.

moved to Fort Stevens, where it could be more economically maintained. Daily bulletins have been exhibited for the benefit of shipping interests, and in view of the benefit of commerce its maintenance is considered a worthy object.

The amount expended on this work to June 30, 1903, was \$7,592.21.

July 1, 1902, balance unexpended.....	\$1, 597. 79
June 30, 1903, amount expended during fiscal year	190. 00
July 1, 1903, balance unexpended	1, 407. 79
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903 Submitted in compliance with requirements of sundry civil act of June 4, 1897. 1, 000. 00	
(See Appendix X X 8.)	

IMPROVEMENT OF CERTAIN RIVERS AND HARBORS IN WASHINGTON.

This district was in the charge of Maj. John Millis, Corps of Engineers. Division Engineer, Lieut. Col. W. H. Heuer, Corps of Engineers.

I. Willapa River and Harbor, Washington.—Willapa Harbor connects with the Pacific Ocean in the extreme southwestern part of the State of Washington. Willapa River flows into the bay at its eastern extremity about 10 miles from the sea entrance to the harbor.

South Bend, the principal town on the bay and the terminus of a branch railroad running from Chehalis, is near the mouth of the river. Willapa city is a small town some 10 miles above. North River is a stream flowing into the bay from the north and the Nasel River is a sort of arm making off southeasterly from the southeast part of the bay proper.

Originally shoals existed in the river below Willapa city, and there was a log jam in North River.

The original and existing project contemplates dredging 100 feet wide and to a depth of 8 feet at low water through the reef just below Willapa city, and the closing of side sloughs near South Bend by means of dikes, with the object of increasing channel depths by scour. Project was dated May 2, 1891; adopted by act of July 13, 1892.

Under acts of August 18, 1894, and March 3, 1899, removal of the log jam in North River was authorized.

The estimated cost is \$36,350.

The amount expended on existing project to close of fiscal year ending June 30, 1903, is \$33,582.04, of which \$1,430.98 was applied to maintenance of dikes.

The best channel depth at low water is now about 14 feet to South Bend and to Willapa city about 9 feet. The average tidal variation is about 8 feet.

During the year the Mailboat Slough dike was refilled and repaired and the opening in the Louderback Slough dike was enlarged to 43 feet wide to accommodate vessels.

The North and Nasel rivers are navigable only for small boats of light draft for a comparatively short distance above their mouths. The principal business on these rivers is rafting and floating logs. The log and lumber business on Willapa Bay and tributary streams is by far the most important part of the water traffic.

Exports and imports.

Calendar year.	Tons.	Value.
1886.....	32,399	\$374,050
1889.....	51,150	755,682
1900.....	42,090	266,080
1901.....	39,538	229,686
1902.....	51,999	402,050

Detailed reports on this work are given in Annual Reports of the Chief of Engineers for 1893, pages 3402-3408, and for 1895, pages 3399-3405. Maps of the locality are published with Annual Report of the Chief of Engineers for 1891, pages 3264 and 3268.

Reports of examinations and surveys are printed in the Annual Report of the Chief of Engineers for 1891, pages 3264-3268; House Document No. 91, Fifty-fourth Congress, second session, and in House Document No. 100, Fifty-fifth Congress, second session.

The full amount for improvement as heretofore authorized by Congress has been appropriated.

By the act of June 13, 1902, the balance on hand to the credit of this improvement may be used in snagging and otherwise improving North and Nasel rivers.

July 1, 1902, balance unexpended.....	\$4, 198. 94
June 30, 1903, amount expended during fiscal year.....	1, 430. 98
July 1, 1903, balance unexpended.....	2, 767. 96

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance unexpended July 1, 1903..... 5,000. 00
 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.
 (See Appendix Y Y 1.)

2. *Grays Harbor and bar entrance, Washington.*—Grays Harbor is a large bay in the southwestern part of the State of Washington, connecting with the Pacific Ocean. It has a total length from east to west of 17 miles, and its greatest breadth north and south is 14 miles.

A large part of the bay is occupied by tide flats, bare at low water. At low tide the area covered by water is estimated at 30.6 square miles, or less than one-third of the total area. There are two main channels crossing the bay from east to west. The north channel is the principal one, and this is being improved under a special appropriation. A short distance within the harbor entrance are large areas affording sheltered anchorages for deep-draft vessels.

The harbor entrance is between two low sandy peninsulas which are about 12,500 feet apart, measured between high-tide lines.

Through this entrance there is a channel having a maximum depth of 100 feet or more. A single broad waterway extends for more than 2 miles out to sea from the entrance, with depths gradually diminishing to 30 feet. At the outer end of this deep waterway lies a bar convex to the sea and extending each way to the sand spits on the two sides of the harbor throat.

Across the bar there was originally no good permanent channel, but there were several variable, shifting channels having depths of about 12 or 13 feet. The general average width of the bar between the inner and outer 18-foot curves was one-half mile.

The original and existing project, dated March 20, 1895, provides for the control of the tidal currents by means of a single jetty extending out to sea from the point on the south side of the harbor throat a distance of about $3\frac{1}{2}$ miles, with a view to improving and maintaining the channel over the bar by scour. The jetty is to be of rubblestone, built above high-tide level. This project contemplates a depth of 24 feet at mean low water.

The estimated cost was \$1,000,000. The existing project was approved by act of June 3, 1896.

The amount expended to June 30, 1903, was \$995,665.12, of which \$21,000 was for maintenance.

The act making the first appropriation for this work authorized the making of a contract or contracts for the completion of the project. In accordance with this authority a contract for the entire work was entered into after due advertisement. This contract was approved by the Chief of Engineers February 23, 1898, and work under it commenced in March, 1898. The available depths over the bar have been materially greater throughout the year than they were before the work was started, but the latest surveys show some diminution of depth from the greatest that has been observed and an apparent widening of the outer channel over the bar.

During the year construction of the jetty was continued under the contract till September 15, when operations ceased, as the funds had been practically exhausted. The rock work of the jetty has been carried to a total distance from high-water line on the ocean side of the spit of 13,784 feet, the extreme outer end being somewhat incomplete. A groin on the north side, 500 feet long, was built at bent 1050, in anticipation of possible scour. At the close of the contract portions of the plant that will be needed in maintenance of the work were purchased of the contractor, the steel rails were taken up, and the plant removed. During the winter the trestle suffered considerable damage. A resurvey of the outer bar was commenced in June, with a view to preparing estimates for completing the work and for any modification of the project that may seem advisable.

Appropriations have already been made to the limit of cost heretofore authorized by Congress. A revision of the project and estimates for completing the work are now in preparation.

The commerce benefited by the work consists at present almost exclusively of exportation of lumber carried in sail vessels and steam schooners. This is very large and rapidly increasing.

Exports and imports.

Calendar year.	Tons.	Value.
1898.....	168,468	\$1,252,089
1899.....	265,918	1,979,986
1900.....	259,692	2,077,057
1901.....	299,607	1,877,800
1902.....	527,047	3,601,163

A report of the survey, giving a full description of this work, with plan, is published in the Annual Report of the Chief of Engineers for 1895, pages 3517-3528, and in Senate Executive Document No. 112. Forty-seventh Congress, first session.

July 1, 1902, balance unexpended	\$164, 121. 10
June 30, 1903, amount expended during fiscal year	159, 786. 22
July 1, 1903, balance unexpended	4, 334. 88
July 1, 1903, outstanding liabilities	149. 33
July 1, 1903, balance available	4, 185. 55

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903..... 30, 000. 00
 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.

(See Appendix Y Y 2.)

3. *Grays Harbor, inner portion between Aberdeen and the entrance to said harbor, and Chehalis River, Washington.*—There are two main channels traversing the inner or eastern part of Grays Harbor from east to west, the North and South channels. There was also formerly a middle channel connecting the North and South channels. The South channel is shoal and is but little used. The North channel is used by all ocean-going vessels entering the harbor. There are two shoals in the North channel, one about $2\frac{1}{2}$ miles below Hoquiam and one between Hoquiam and Aberdeen. The ruling depth over these shoals is 8 feet at mean low water.

The original project of April 29, 1890, for the inner harbor, adopted by act of July 13, 1892, provides for the construction of pile, brush, and stone dikes to partly close up the South and Middle channels and concentrate the flow of water in the North channel, thereby increasing the depth of water by scour. The shoals above and below Hoquiam were to be dredged to a depth of 16 feet at half tide.

The estimated cost was \$150,000.

The amount expended to June 30, 1903, was \$74,711.17, none of which was applied to maintenance.

No work has been done on the inner harbor since September, 1895. At that time two middle dikes and a protecting sill with an aggregate length of 13,986 feet had been constructed in the inner harbor, and six high-tide dikes with an aggregate length of 1,476 feet had been constructed in the Chehalis River. The depth of water over the shoals in the inner harbor was increased about 2 feet and over the shoals in the Chehalis River from $2\frac{1}{2}$ feet to 7 feet, but these depths were not permanent.

The Chehalis River is in the southwestern part of Washington. It has a westerly course and empties into Grays Harbor Bay at its eastern extremity.

From the mouth to Montesano, 15 miles, there is about 10 feet of water at high tide. From Montesano to Elma, 16 miles, there is generally sufficient water for light-draft boats. There is practically no navigation above Elma and no regular boats go above Montesano. The river is used extensively for floating saw logs.

The original project, adopted by act of August 2, 1882, contemplates the removal of snags and other obstructions which may accumulate in the portion of the river regularly used by boats. The estimated cost is indefinite. Date of project, January 26, 1882.

The amount expended to June 30, 1903, including that spent during the last fiscal year under the consolidated project, was \$19,983.72, of which \$17,418.24 was for maintenance of navigation on the Chehalis River.

The existing project for expenditure of available funds under the consolidated appropriation contemplates snagging and clearing obstructions in the Chehalis River, repairs to the dikes, and the excavation of a channel about 100 feet wide and 15 feet deep at low water through the shoals near Aberdeen and Hoquiam. Snagging and removal of obstructions in the Chehalis River was done with a hired plant, and at the close of the year the river had been nearly cleaned out. A steam schooner loaded to 12 feet was enabled to come down the river from Montesano and go to sea.

A resurvey of the inner harbor was completed and survey for revision of the harbor lines at Hoquiam and Aberdeen was made.

Location of proposed dredged channel was made and at the close of the year plans and specifications were nearly ready to advertise the work.

Report of examination and survey of the inner harbor and the Chehalis River, with maps, was published in the Annual Report of the Chief of Engineers for 1891, pages 3297-3305.

General reports on Chehalis River are printed in Annual Report of the Chief of Engineers for 1875, pages 799-800, and for 1882, pages 2687-2690.

Reports of surveys are published in Annual Report of the Chief of Engineers for 1875, page 799; for 1882, page 2686, and of examination and survey printed in Senate Executive Document No. 112, Forty-seventh Congress, first session.

The maximum draft that can be carried in the inner harbor is 8 feet, and in the Chehalis River 4 feet at low water.

The average range of tide in the inner harbor is 7 feet, in the Chehalis River 5 feet.

The commerce benefited by this improvement consists very largely of floating and towing logs and carrying lumber in sailing vessels and steam schooners.

Exports and imports.

Calendar year.	Tons.	Value.
1898	2, 730	\$293, 610
1899	2, 232	352, 316
1900	4, 376	132, 157
1901	5, 706	200, 264
1902	3, 529	157, 532

July 1, 1902, balance unexpended	\$51, 870. 59
June 30, 1903, amount expended during fiscal year	2, 565. 48

July 1, 1903, balance unexpended	49, 305. 11
July 1, 1903, outstanding liabilities	260. 00

July 1, 1903, balance available	49, 045. 11
---------------------------------------	-------------

{ Amount (estimated) required for completion of existing project	" 25, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Y Y 3.)

^a This is the amount required for completion of Grays inner harbor below Aberdeen, and has no reference to the estimated amount required for completing the general improvement of Chehalis River, for which work the estimate is indefinite.

4. *Puget Sound and its tributary waters, Washington.*—Most of the channels of Puget Sound proper have ample depths for purposes of navigation, but the extensive lumber and fishing industries in these waters render it very important to maintain a general supervision over the navigable channels to regulate the construction of fish traps, log booms, and other structures incident to these important industries and to prevent obstructions which are detrimental to these as well as other navigation interests. A number of streams and rivers tributary to Puget Sound are of great value to boat navigation and for logging purposes so far as depth and width are concerned, but they are all liable to be obstructed by the débris generally found in streams flowing through a heavily wooded country.

Former projects were as follows: That of November 18, 1880, for the improvement of the Nooksak River; of June 30, 1880, for the Skagit River; of November 19, 1880, for the Stilaguamish River. These were adopted by act of August 2, 1882. By act of June 14, 1880, \$2,500 was made available for removal of obstructions in the Skagit River, based on an examination made in 1875.

By act of July 13, 1892, and in subsequent acts, the appropriation has been made in its present general and comprehensive form, greatly to the advantage and economy of the work.

The existing project for the general improvement of Puget Sound contemplates the removal of snags and other obstructions in any of the waters or channels where such removal may become necessary. The work is mostly attended to by a snag boat owned by the Government. The estimated cost is indefinite, as the maintenance of the channels and the necessary supervision over them require constant work.

The act of June 13, 1902, appropriated \$35,000 for this work, including maintenance, and authorized the expenditure of \$15,000 of this amount for removing the log jam in Nooksak River or cutting a new channel around the jam, in the discretion of the Secretary of War.

Advertisement for proposals for removing the jam and specifications for doing the work were issued on June 17, 1903, bids to be opened July 17, 1903.

The amount expended to June 30, 1903, was \$201,167.36.

The snag boat has been in operation during the entire year, except when laid up temporarily for repairs, and the rivers and streams have been kept clear of obstructions. The streams worked on were the Skagit and its tributaries, the Snohomish, Snoqualmie, and Skykomish, the Stilaguamish, and Duwamish.

All these streams are used for floating logs and shingle bolts to a greater or less extent, and for towing log rafts and the timber naturally constitutes the main part of the commerce. The distance up stream to which boats run is extremely variable, depending on the stage of water and tide. Steamboat navigation on the Skagit does not extend above Sedro Woolley, a distance of 25 miles, except at high stages. On the Stilaguamish boats do not go above Florence, 6 miles from the mouth. The Snohomish is navigable for river boats to The Forks, 22 miles, and the lower portions of its tributaries, the Snoqualmie and Skykomish, are navigable at high stages. On the Duwamish small boats go as far as the electric railroad bridge, 5 miles from the mouth. In case of each river, the distance to which steamboat navigation actually extends is less and the distance over which towing and floating of logs extends

is greater than the distances above named. None of these streams is closed in winter by ice.

A general survey of the lower Nooksak River and of the log jam was made in connection with preparation of project for opening the river.

The water traffic on Puget Sound and its tributary waters is very large and rapidly growing. It includes vessels of about every type and size in use throughout the world, but it is quite impracticable to give in the form of concise statistics a condensed statement of the amount and value of the commerce more or less directly benefited by work under this appropriation. Statistics have been compiled only for the tributary streams on which the snag boat has mostly worked.

Exports and imports.

Calendar year.	Tons.	Value.
1898	12, 676	\$539, 406
1899	13, 500	577, 586
1900	35, 066	1, 324, 926
1901	30, 155	1, 499, 420
1902	61, 794	2, 324, 980

Reports of examinations and surveys of the rivers of Puget Sound are printed in Senate Executive Document No. 39, Forty-sixth Congress, third session, House Executive Document No. 38, Fifty-first Congress, second session, and House Document No. 204, Fifty-fifth Congress, second session.

The opening of the Nooksak River, now provided for, and the large increase in the commerce on the streams and channels, particularly in that relating to the lumber business, call for an increased annual expenditure for maintaining navigation.

July 1, 1902, balance unexpended	\$41, 166. 94
June 30, 1903, amount expended during fiscal year	13, 834. 30

July 1, 1903, balance unexpended	27, 332. 64
July 1, 1903, outstanding liabilities	1, 470. 38

July 1, 1903, balance available	25, 862. 26
---------------------------------------	-------------

Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	30, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Y Y 4.)

5. *Harbor at Olympia, Wash.*—Olympia is situated at the extreme southern point of Puget Sound, at the head of Budd Inlet. The upper end of this inlet is shoal. Shoal water extends northward from the Fourth Street Bridge for a distance of 8,750 feet to a depth of 12 feet at mean lower low water in Budd Inlet. Originally nothing but shallow-draft boats could reach the wharves near Fourth Street Bridge, and those only at high tide.

The original and existing project, dated September 18, 1891, and adopted by act of July 13, 1892, contemplates dredging a channel 250 feet wide and 12 feet deep at the mean of the lower low waters from the vicinity of the Fourth Street Bridge to deep water in Budd Inlet.

Near its inner end the channel is to be widened to 500 feet so as to provide a turning basin for boats using it. The estimated cost is \$147,000. The full amount for this improvement as heretofore authorized by Congress has been appropriated.

The amount expended to June 30, 1903, was \$123,264.76, none of which was for maintenance.

The channel has been dredged to the full depth contemplated for the full width of 250 feet over a part of its length and for a width of 150 feet throughout the remainder. The channel depth at mean low water at the close of the year was about 10 feet. The average tidal variation is about 11 feet.

A resurvey of the harbor was made in connection with preparation of plans for additional dredging.

Proposals for dredging the harbor were opened December 18, 1902. Under date of January 27, 1903, a contract was entered into with the Puget Sound Bridge and Dredging Company for doing the work, the contract requiring completion of the work October 18, 1903. No dredging had been done at the close of the year.

The commerce of the harbor is of general character, and is carried on by a variety of the smaller classes of boats plying between the ports of Puget Sound. Sufficient depth for seagoing vessels has not yet been secured, though vessels of the deepest draft can go as far as the entrance of the dredged channel.

Exports and imports.

Calendar year.	Tons.	Value.
1898.....	52,335	\$1,203,226
1899.....	42,694	1,173,694
1900.....	35,466	848,708
1901.....	44,569	961,435
1902 ^a		

^a The various persons and firms who were requested to furnish data necessary for the commercial statistics have not responded so as to permit completion of the statistics at the date of this report.

Description and map are published in Annual Report of the Chief of Engineers for 1900, pages 4481-4483.

Reports on examination and survey of Olympia Harbor are published in Annual Report of the Chief of Engineers for 1892, pages 2734-2741, and on survey of Deschutes River in House Document No. 104, Fifty-fifth Congress, second session.

July 1, 1902, balance unexpended	\$25,000. 00
June 30, 1903, amount expended during fiscal year	1, 264. 76
July 1, 1903, balance unexpended.....	23, 735. 24
July 1, 1903, amount covered by uncompleted contracts.....	16, 445. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Y Y 5.)

6. *Tacoma Harbor, Washington.*—At the southern end of the harbor are extensive tide flats which are bare at low water. Outside of these

tide flats the depth increases very rapidly up to depths of 200 feet or more, reaching depths as great as 600 feet at the mouth of the bay, about 3 miles distant from the low-water line at its southern end. The principal water front of Tacoma is along the southwestern shore of the bay. Harbor lines have been established around the south end of the bay and along its western side. In order to facilitate commerce several waterways extending into the flats or tide lands have been laid out. One of these is known as the City or West Waterway. The harbor of Tacoma may be considered to embrace all of Commencement Bay, including the waterways mentioned.

The original and existing project of November 13, 1900, approved by the act of June 13, 1902, contemplates dredging in the City Waterway from deep water in Commencement Bay to Eleventh street to a depth of 25 feet, from Eleventh street to Fourteenth street to a depth of 18 feet, and from Fourteenth street to the south end of waterway to a depth of 15 feet, at extreme low water.

The river and harbor act of June 13, 1902, provides "That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary for the prosecution of said project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate one hundred thousand dollars, exclusive of the amount herein appropriated." The amount appropriated by above act was \$75,000. The sundry civil act of March 3, 1903, appropriated \$100,000 for continuing the work. Under date of February 24, 1903, a contract was entered into with Mr. Raymond A. Perry for dredging the City Waterway to the extent of the amount available. Dredging commenced on June 4, 1903, with a small plant. By the close of the year about 7,400 cubic yards was taken out.

A larger plant, consisting of a powerful suction dredger, is under construction, and at the close of the year the hull had been launched and good progress had been made with the building and installing of the machinery.

The shoalest part of the area to be improved is practically inaccessible at present to vessels of any class.

The commerce to be benefited by this improvement is of a large and extremely varied character, including that carried on by Sound and river types of boats, as well as that of the largest steam and sailing vessels. A very important item is the export of grain, in which the port of Tacoma exceeds all other ports on Puget Sound.

It is expected that report of the examination and survey of the Puyallup and other waterways of Tacoma Harbor, authorized by the river and harbor act approved June 13, 1902, will be submitted to Congress in December, 1903.

Report of a survey of "mouth of Puyallup River, Washington," is published in Annual Report of Chief of Engineers, 1898, pages 3098-3102.

Description of proposed work is published in Annual Report of the Chief of Engineers for 1901, pages 3593-3602.

Report on examination and survey is published in House Document No. 76, Fifty-sixth Congress, second session.

July 1, 1902, balance unexpended	\$75,000.00
Amount appropriated by sundry civil act approved March 3, 1903	100,000.00
	175,000.00
June 30, 1903, amount expended during fiscal year	2,281.99
	172,718.01
July 1, 1903, balance unexpended	172,718.01
July 1, 1903, outstanding liabilities	410.98
	172,307.03
July 1, 1903, balance available	172,307.03
July 1, 1903, amount covered by uncompleted contracts	135,240.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903.....	5,630.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
(See Appendix Y Y 6.)	

7. *Waterway connecting Puget Sound with lakes Union and Washington, Washington.*—Lakes Union and Washington are bodies of fresh water near Puget Sound in the immediate vicinity of the city of Seattle. The proposed improvement contemplates a ship canal connecting them both with the Sound. There is no navigable connection at present.

The river and harbor act of September 19, 1890, contained an item directing the appointment of a Board of three officers of the Corps of Engineers to select and survey the most feasible location and to estimate the expense of constructing a ship canal to connect the waters of lakes Union, Washington, and Samamish with Puget Sound. The sum of \$10,000 was appropriated for the necessary expenses.

This Board did not consider that part of the proposed waterway connecting with Lake Samamish of sufficient importance or value to justify the cost, and the connection of Lake Samamish with Puget Sound has not been seriously considered since that date.

Subsequently a detailed survey and location of the proposed canal were made in compliance with a clause in the sundry civil act of March 2, 1895.

The western end of the canal through Salmon or Shilshole Bay, instead of through Smiths Cove, as once proposed, and a modification of the location of the lower lock were recommended by a Board of Engineer officers and approved by the Secretary of War August 14, 1898.

At this stage the project for the work as adopted by Congress was understood to contemplate the construction of a ship canal from the waters of Puget Sound through Salmon Bay to Lake Union, and thence to Lake Washington, to include dredging through the flats immediately outside of Salmon Bay to a lock in the lower end of Salmon or Shilshole Bay, the construction of this lock, dredging inside of the lock through Salmon Bay, the digging of a canal from the upper end of Salmon Bay to Lake Union, dredging to the eastern end of Lake Union, and the construction of a canal and lock between lakes Union and Washington. The canal section and the lock dimensions were to be such as would accommodate the largest merchant vessels and ships of war.

The approximate cost under this project was estimated at \$6,500,000. A revision of the project has been ordered by Congress.

Amount expended to June 30, 1903, \$202,205.03. Of this amount \$5,000 was expended in making a survey.

A channel 50 feet wide on the bottom and 16 feet deep below low water has been cut from deep water in Puget Sound along the axis of the canal for a distance of 6,000 feet. The work was done by contract and was completed October 15, 1902. The total amount of material removed was 323,527 cubic yards, of which amount 128,473 cubic yards was taken out during the fiscal year.

A cut 10 feet wide on the bottom and 10 feet above the bottom of the proposed canal has been excavated between the head of Salmon Bay and Lake Union. The total length of cut made is 4,500 feet. The last contract on this section was completed February 3, 1903. The total amount of material removed from this section was 100,417 cubic yards, of which amount 32,217 cubic yards was taken out during the fiscal year.

The tidal variation at Salmon Bay is 17 feet.

The act of June 13, 1902, appropriated \$160,000 for continuing the improvement, but confined the work to securing a low-water channel 10 feet in depth from Shilshole Bay through Salmon Bay to the wharves at Ballard.

Under date of January 26, 1903, a contract was entered into with the Puget Sound Bridge and Dredging Company to excavate a channel from Shilshole Bay to the wharves at Ballard, the channel to be 50 feet wide on the bottom and of the prescribed depth. In the natural condition of Salmon Bay the wharves at Ballard are entirely inaccessible to vessels except at high tide, and then they can only be reached by boats of light draft. At the close of the year the contract was about 42 per cent completed. The total estimated amount of material to be removed is 280,000 cubic yards.

The act of June 13, 1902, provided for a Board of Engineer officers to reexamine the whole question of a ship canal connecting with Lake Washington by various routes, including proposals from a private company to construct such a canal, and stipulated that nothing in said act should be construed as adopting any project for construction of the waterway. The report of the above Board of Engineers is published in Senate Document No. 127, Fifty-seventh Congress, second session, and is printed herewith as Appendix Y Y 12.

Description of the work, etc., are published in Annual Reports of the Chief of Engineers for 1892, page 2762 et seq., and for 1896, page 3356 et seq. Estimate of approximate cost, \$6,331,672, with map showing main features of canal, is published in House Document No. 335, Fifty-seventh Congress, first session, and in the Annual Report for 1902, at page 2419.

Reports of examinations and surveys are published in House Executive Document No. 40, Fifty-second Congress, first session, and Senate Document No. 269, Fifty-fourth Congress, first session.

The present commerce benefited by the improvement of the channel to Ballard is the towing of logs to the mills at Ballard and the export of lumber and shingles from that place. Logs are brought in in rafts, and lumber is loaded on lighters at the mills and then towed to the open Sound, where it is placed on sailing vessels.

Exports and imports

Calendar year.	Tons.	Value.
1901	210,565	\$402,950
1902	178,074	352,401

In previous reports exports and imports of the port of Seattle have been included. The above includes only the present commerce of Ballard and Salmon Bay, Lake Union, and Lake Washington.

July 1, 1902, balance unexpended	\$244, 227. 68
June 30, 1903, amount expended during fiscal year	111, 432. 71
July 1, 1903, balance unexpended	132, 794. 97
July 1, 1903, outstanding liabilities	293. 17
July 1, 1903, balance available.....	132, 501. 80
July 1, 1903, amount covered by uncompleted contracts.....	71, 926. 75
(See Appendix Y Y 7.)	

8. *Everett Harbor, Washington.*—At this harbor the southern part of the water front has ample depth and is accessible for vessels of the deepest draft. The northern portion is at present inaccessible on account of the delta formation or tide flats off the mouth of the Snohomish River.

Under date of November 4, 1893, the Acting Secretary of War granted to the Everett Land Company authority to construct certain works designed to produce a fresh-water basin at Everett that would be available for all commercial shipping, but no work was ever done in carrying out the project.

The first appropriation for the improvement of Everett Harbor was in the act of August 18, 1894—

For dredging Everett Harbor, including mouth of Snohomish River, and Snohomish River from mouth to Lowell, in the State of Washington, the sum of \$10,000.

It was decided that no dike or bulkhead construction could be done under this appropriation, and that dredging alone would not be of value, so the funds were not applied. Subsequently the dike construction was authorized by resolution of Congress dated February 1, 1895, and the project under which the original and subsequent appropriations have been applied may be stated as follows:

First, to excavate a harbor basin in the shallows and tide lands adjoining deep water near the river's mouth; second, to dredge a channel from this through the tide flats and the Old River mouth to deep fresh water in the Snohomish River, this channel being designed to bring fresh water to the harbor basin and to afford facilities for navigation about the peninsula and into the deep water of the river bounding the peninsula on the east; and third, to protect and maintain this harbor and channel across the tide flats by a bulkhead interposed between them and the open waters of the Sound, the bulkhead to act as a retaining wall for the material dredged from the harbor. The date of approval of this plan was February 14, 1895.

By authority of joint resolution of Congress approved April 23, 1902, the work in Old River was discontinued, and the further expenditure of the funds has been for deepening and widening the harbor basin and channel through the tide flats and repairing the bulkheads.

The estimated cost of the improvement is \$422,000, all of which has been appropriated.

The amount expended on the project to June 30, 1903, was \$384,493.58.

A dike for the purpose of retaining the dredged material has been built from the lower end of Smiths Island along the established bulkhead line for a distance of 19,336 feet. At the southern end of this work an outside bulkhead 200 feet from the other has been built for

a distance of 2,600 feet. These dikes have been repaired, raised, and strengthened. The channel leading north from the basin had been partly dredged for a distance of 11,600 feet downstream before this part of the work was discontinued under the resolution of Congress above referred to.

The harbor basin has been dredged for the full length of 5,500 feet and for nearly the full width of 400 feet and full depth of 26 feet at mean lower low water.

The harbor of Everett is freely accessible to vessels of deepest draft up to the entrance to the dredged harbor basin. The water traffic is varied in character and is carried on by sea-going vessels and the various types of Sound and river boats. Lumber products, paper, and flour are the principal items of the export trade.

Exports and imports.

Calendar year.	Tons.	Value.
1898	55,480	\$2,545,054
1899	42,713	1,477,120
1900	55,094	1,820,561
1901	71,881	2,712,260
1902	85,263	4,024,584

Description of the work and maps are published in Annual Report of the Chief of Engineers for 1895, pages 3430-3435, and for 1901, pages 3587-3589.

Reports on examinations, surveys, etc., are published in House Executive Document No. 47, Fifty-second Congress, second session, and Senate Executive Documents Nos. 53, 139, and 139, part 2, Fifty-third Congress, second session.

July 1, 1902, balance unexpended	\$127,251.77
June 30, 1903, amount expended during fiscal year	89,745.35

July 1, 1903, balance unexpended	37,506.42
July 1, 1903, outstanding liabilities	253.00

July 1, 1903, balance available	37,253.42
---------------------------------------	-----------

July 1, 1903, amount covered by uncompleted contracts.....	27,027.27
--	-----------

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance available July 1, 1903	10,000.00

(See Appendix Y Y 8.)

9. *Swinomish Slough, Washington.*—This slough affords an inland sheltered passage for small vessels from Puget Sound proper northward to Bellingham Bay and the Gulf of Georgia, and it is the only means of communication to the town of Laconner, located on the slough. The total distance by way of the slough from good water in Skagit Bay to navigable depths in Padilla Bay is about 11 miles.

At the northern end the slough opens out into the flats forming the southern portion of Padilla Bay, in the midst of diked land and marshes. At the southern end the best channel to deep water in Saratoga Passage crosses extensive flats, which are almost bare at low water.

The original project, dated December 14, 1891, and adopted by act of July 13, 1892, contemplates dredging a channel 4 feet deep and 100 feet wide from deep water in Saratoga Passage across Skagit flats, through the shoals of the slough proper and across the flats of Padilla Bay to deep water, and to build dikes in Skagit and Padilla bays to direct the tidal currents through the dredged channels.

The original estimated cost is \$122,000. The full amount of the original estimate has been appropriated, and a revision of the estimate will be necessary.

The amount expended to June 30, 1903, was \$98,766.55, of which \$28,317.96 was for maintenance.

The dike work completed to date is all between Laconner and deep water in Saratoga Passage, as follows: Single row of piles to catch drift between Goat and Ika islands, 4,000 feet; wattled pile dike, 3,000 feet; pile, brush, and stone dike, 7,200 feet.

A considerable portion of this has been rebuilt and repaired. A channel of the depth and width contemplated by the project has been dredged from deep water at the southern end northward to about the middle point of the slough. Some local shoaling has occurred, and not over 2 feet can be carried through to Laconner from Saratoga Passage at low water. Through traffic has not yet been benefited, as the improvement has not been extended to Padilla Bay.

The average tidal variation is about 8 feet.

During the year general repairs were made to the inner dike extending from Gallahers Point to McGlinns Island. This dike had greatly deteriorated, and there was a large break near the inner end. Other breaks developed as the work progressed. A resurvey of the channel from Laconner to deep water in the sound was made with a view to preparation of project and estimates for applying the available appropriation.

The work yet to be done, according to the original estimate, includes 6,000 linear feet of dike in Padilla Bay, 6,000 linear feet of dike in the slough proper, 90,000 cubic yards of dredging in Padilla Bay, and 30,000 cubic yards of dredging in the slough proper. Additional work in channels already dredged and repairs to the dikes will also be required.

Exports and imports.

Calendar year.	Tons.	Value.
1898	19, 625	\$882, 345
1899	76, 636	2, 028, 454
1900	74, 516	1, 611, 460
1901	186, 747	2, 991, 330
1902	49, 914	1, 472, 847

A report on examination and survey of Swinomish Slough, upon which the plan of improvement is based, is printed with a general map in House Executive Document No. 31, Fifty-second Congress, first session, and reprinted without map in the Annual Report of the Chief of Engineers for 1892, pages 2752-2762.

A map showing parts of the improvement is published in the Annual Report of the Chief of Engineers for 1900, opposite page 4488.

July 1, 1902, balance unexpended	\$34,551.41
June 30, 1903, amount expended during fiscal year	8,317.96
July 1, 1903, balance unexpended	26,233.45
July 1, 1903, outstanding liabilities	114.00
July 1, 1903, balance available	26,119.45
{ Amount (estimated) required for completion of existing project	17,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance, in addition to the balance available July 1, 1903	20,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

(See Appendix Y Y 9.)

10. *New Whatcom Harbor, Washington.*—The mud flats in New Whatcom Harbor extend from the meander line to the 12-foot curve, a distance of 3,400 feet.

A system of harbor lines for this harbor approved by the Secretary of War under date of June 3, 1892, provides for three waterways leading from deep water to the meander line.

The original and existing project, dated June 14, 1897, adopted by the act of June 13, 1902, contemplates dredging the Whatcom Creek waterway to a depth of 12 feet at mean lower low water and 200 feet wide from deep water as far as the railroad bridge and to its full width inside this bridge. The estimated cost is \$80,000.

The river and harbor act of June 13, 1902, provided "that no part of this appropriation [\$25,000] shall be expended until provision shall have been made, satisfactory to the Secretary of War, to prevent the deposit, in the channel to be improved, of sawdust and refuse from the mills."

On May 26, 1903, report was made to the Chief of Engineers that the above requirements had been complied with by the mill owners, and expenditure of the appropriation for the execution of the work authorized by Congress was authorized by the Secretary of War on June 9, 1903.

Advertisement for proposals and specifications for doing the work were issued on June 22, 1903, bids to be opened July 22, 1903.

Description of proposed work is published in Annual Report of the Chief of Engineers for 1897, pages 3478-3481.

Reports on examination and survey are published in House Executive Document No. 228, Fifty-third Congress, third session, and House Document No. 80, Fifty-fifth Congress, first session.

The commerce of this port is of a general nature, consisting largely of lumber, shingles, and fish. Vessels of the deepest draft can go as far as the entrance of the proposed dredged channel.

The exports and imports for the calendar year 1902 amounted to 87,118 tons, valued at \$2,872,789.

July 1, 1902, balance unexpended	\$25,000.00
July 1, 1903, balance unexpended	25,000.00
July 1, 1903, outstanding liabilities	138.50
July 1, 1903, balance available	24,861.50
{ Amount (estimated) required for completion of existing project	55,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	35,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Y Y 10.)

11. *Okanogan and Pend Oreille rivers, Washington.*—(a) *Okanogan River.*—This river rises in Canadian territory, flows in a southerly direction, and empties into the Columbia. The lower portion, for a distance of 87 miles, lies in the northeastern part of Washington. The river has a general width of 300 to 400 feet through its entire length in the United States, and the lower portion has sufficient depth for light-draft navigation throughout the year, but it is obstructed in places by shoals and rocks which prevent any navigation except during the summer high water. The upper stretches are also obstructed by snags.

The original and existing project, dated December 18, 1897, adopted by act of March 3, 1899, contemplates rock removal, the construction of wing dams, and snagging.

The estimated cost is \$30,000. The amount expended to June 30, 1903, was \$22,176.66.

Work of removing rocks and bowlders, wing-dam construction, and placing posts to assist vessels in hauling over rapids has been done at various points over about 40 miles of the lower portion of the river. It is estimated that the available depth has been increased about 1 foot.

Work was carried on during the fiscal year from September 10, 1902, to December 21, 1902, and consisted of removing bowlders, dam construction, and scraping the shoal bars between the mouth of the river and Ophir, a distance of 11 miles, which resulted in an increased depth of from 10 inches to 16 inches on six rapids, and the channel made not less than 70 feet in width. Length of dams constructed, 522 feet; riprap placed, 266 feet; bowlders removed, 730 tons.

The commerce of the river is carried on in small river steamers and consists of general traffic. During favorable stages boats run as far up as Johnsons Creek, 41 miles above the mouth.

Exports and imports.

Calendar year.	Tons.	Value.
1899	1,733	\$151,415
1900	(a)	(a)
1901	983	
1902	1,571	119,065

a Not obtainable.

The increased depth has rendered the river navigable for a longer period of the year than formerly was the case.

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1888, page 3121.

Report on examination of Okanogan River is published in Annual Report of the Chief of Engineers for 1895, page 3475; report of survey is printed in House Document No. 211, Fifty-fifth Congress, second session.

(b) *Pend Oreille River.*—This river forms the outlet of Pend Oreille Lake, in the northern part of Idaho.

The obstructions to navigation consist of rocks and shoals in Box Canyon, and in the section between this canyon and Albany Falls.

The original and existing project, dated December 28, 1897, and adopted by act of March 3, 1899, contemplates the improvement of Box Canyon by the removal of submerged rocks, the blowing off of

projecting rocky points, and the removal of submerged rocks between Box Canyon and Albany Falls. The estimated cost is \$30,000.

The amount expended to June 30, 1903, was \$9,032.84, none of which was directly for maintenance.

The work done has resulted in partly clearing away the obstructions in Box Canyon, but this produced little or no benefit to navigation. On account of the character of the improvement, no benefit is to be expected until the improvement is further advanced.

No work was done during the fiscal year ending June 30, 1903, as the amount available was thought to be too small to justify purchase of a plant and it was hoped to advance work on the Okanogan so the plant from that river could be used on the Pend Oreille. A general examination of the Pend Oreille was made.

The river is navigable throughout the year from Newport down to Box Canyon, a distance of 54 miles.

The commerce consists of towing logs and general traffic carried on by a number of small vessels. Heavy freight is carried mainly on barges in tow.

Exports and imports.

Calendar year.	Tons.	Value.
1899	2, 617	\$129, 677
1900	1, 921	97, 125
1901	13, 917	134, 280
1902	15, 868	500, 200

Descriptions of the river and the plan of improvement are given in the Annual Report of the Chief of Engineers for 1898, page 3124.

Report of survey of the river is printed in House Document No. 235, Fifty-fifth Congress, second session.

The act of June 13, 1902, provides as follows:

Improving the Okanogan and Pend Oreille rivers, Washington, twenty-two thousand five hundred dollars, of which amount so much as may be necessary shall be used for completing the improvement of the Okanogan, and the remainder for continuing improvement and for maintenance of the improvement of the Pend Oreille.

July 1, 1902, balance unexpended	\$23, 715. 50
June 30, 1903, amount expended during fiscal year	7, 425. 00

July 1, 1903, balance unexpended	16, 290. 50
July 1, 1903, outstanding liabilities	72. 45

July 1, 1903, balance available	16, 218. 05
---------------------------------------	-------------

(Amount (estimated) required for completion of existing project	^a 12, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance available July 1, 1903	^a 7, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

(See Appendix Y Y 11.)

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

For examinations, surveys, and contingencies of rivers and harbors an appropriation of \$300,000 should be made, as follows:

For examinations, surveys, and contingencies, and for incidental repairs for rivers and harbors, for which there may be no special appropriation; for all expenses con-

^aFor Pend Oreille River.

nected with the inspection of bridges reported as obstructions to navigation, with the service of notices required in such cases, with the location of harbor lines under the act of March 3, 1899, and with the examinations and reports by officers of the Corps of Engineers and by Boards of Engineers upon plans for bridges authorized by law to be built, and upon bridge bills, reports on which may be called for by Congress, \$300,000.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

Section 3 of the river and harbor act of June 13, 1902, provides for the organization in the Office of the Chief of Engineers, by detail from time to time from the Corps of Engineers, of a Board of five engineer officers, whose duties shall be fixed by the Chief of Engineers, and to whom shall be referred for consideration and recommendation, in addition to any other duties assigned, so far as in the opinion of the Chief of Engineers may be necessary, all reports upon examinations and surveys provided for by Congress and all projects or changes in projects for works of river and harbor improvement theretofore or thereafter provided for, etc.

The Board was constituted July 28, 1902, by the appointment of the following officers of the Corps of Engineers: Col. A. Mackenzie, Maj. H. F. Hodges, Maj. Edward Burr, Capt. C. H. McKinstry, and Capt. W. V. Judson.

On May 7, 1903, Colonel Mackenzie was succeeded as senior member of the Board by Lieut. Col. Chas. J. Allen, Corps of Engineers.

Under the provisions of section 14 of the river and harbor act of June 13, 1902, all reports on preliminary examinations and surveys provided for in that act have been referred to the Board for examination and review; in addition, the projects for certain improvements have been presented to it for report, by resolution of the House Committee on Rivers and Harbors, and by the Chief of Engineers. The reports rendered by the Board from time to time will be presented to Congress at its next regular session.

SUPERVISION OF THE HARBOR OF NEW YORK.

The supervisor of the harbor during the past year was Commander Edward F. Qualtrough, U. S. Navy.

The office of supervisor of the harbor of New York was created by act of Congress approved June 29, 1888, entitled "An act to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses." This act has been amended by section 3 of the act of August 18, 1894, entitled "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," by which amendment the functions and powers of the officer have been greatly enlarged. Additional duties are also conferred on the supervisor by section 2 of the last-named act.

Under the provisions of section 5 of the act of June 29, 1888, a line officer of the Navy is designated to discharge the duties created by the act under the direction of the Secretary of War. On May 23, 1889, the Secretary of War directed that all communications in connection with these duties should be addressed to him through this office, and on February 1, 1890, he further directed that the powers conferred upon him by the act should be exercised through the Chief of Engineers.

The report of Commander Qualtrough for the fiscal year ending June 30, 1903, is submitted as Appendix Z Z.

Estimates for the fiscal year ending June 30, 1905.—The estimates of funds required for this service for the fiscal year ending June 30, 1905, are given in the above-mentioned report, as follows:

For pay of inspectors, deputy inspectors, office force, and expenses of office..	\$10, 260
For pay of crews and maintenance of six steam tugs and one launch	63, 000
Total	73, 260

CALIFORNIA DÉBRIS COMMISSION.

The act of Congress approved March 1, 1893, provided for the establishment of the California Débris Commission, to consist of three officers of the Corps of Engineers, appointed by the President, with the concurrence of the Senate, whose functions relate to hydraulic mining in the territory drained by the Sacramento and San Joaquin river systems in California.

Regulation of hydraulic mining.—The Commission is empowered to devise means and issue permits for resuming and carrying on hydraulic mining operations under conditions that will not injure other interests in the State.

The members of the Commission during the past fiscal year were Col. D. P. Heap, Lieut. Col. W. H. Heuer, and Capt. R. P. Johnston.

Up to June 30, 1903, the Commission received 620 applications to mine by the hydraulic process, and granted 476 permits.

The Commission submits an estimate of \$15,000 as the amount required during the fiscal year ending June 30, 1905, for payment of the necessary expenses connected with the work of regulating hydraulic mining as required by the act of Congress approved March 1, 1893.

Improvement and protection of rivers.—The act of Congress approved March 1, 1893, creating the California Débris Commission, also empowered and required the Commission to adopt plans for improving the navigation of the rivers in the systems above mentioned, and to project and construct works for impounding detritus and preventing the deterioration of the rivers from the deposit of hydraulic mining and other débris. Under this requirement of the act the Commission prepared a project and plans for impounding débris in the Yuba River, at an estimated cost of \$800,000. (Project printed in H. Doc. No. 431, 56th Cong., 1st sess.; also printed in the Annual Report of the Chief of Engineers for 1900, Part VIII, p. 5030.)

The estimated cost of this project has now been appropriated, \$400,000 by Congress and \$400,000 by the legislature of California, the appropriations by Congress having been made with provisions that one-half the expense should be paid by the State of California.

The amount expended by the United States on the work of the project above referred to, up to the close of the fiscal year ending June 30, 1903, is \$8,259.26, and was in payment of one-half the purchase price of lands required in connection with the above-named project, and in payment of one-half the cost of some preliminary construction work on the dam designated in said project as "Barrier No. 1."

On account of high water during the winter and spring months, and also on account of some necessary changes in the plans and methods of construction, it was not practicable to accomplish more than a limited

amount of work during the past fiscal year. For these reasons, also, no permanent advantages have as yet been derived under this project.

The following money statement includes only funds appropriated by Congress, and does not include funds appropriated by the legislature of California:

July 1, 1902, balance unexpended	\$394,862. 75
June 30, 1903, amount expended during fiscal year	2,922. 01
July 1, 1903, balance unexpended	391,740. 74
July 1, 1903, outstanding liabilities	4,060. 52
July 1, 1903, balance available	387,680. 22

(See Appendix A A A.)

MISSISSIPPI RIVER COMMISSION.

The Mississippi River Commission, constituted by act of Congress of June 28, 1879, is in charge of the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including the rectification of Red and Atchafalaya rivers at their junction with the Mississippi, the building of levees, and the improvement of the several harbors for which specific appropriations have been made, with the exception of the harbor of Vicksburg and the mouth of Yazoo River. It is also charged with the survey of the Mississippi River from Head of Passes to its headwaters, and with gauging the river and its tributaries.

The Commissioners during the past fiscal year were: Col. Amos Stickney, Corps of Engineers, president, to February 25, 1903; Col. O. H. Ernst, Corps of Engineers, president, since February 25, 1903; Lieut. Col. H. M. Adams, Corps of Engineers; Maj. Thos. L. Casey, Corps of Engineers; B. M. Harrod, Robert S. Taylor, Henry L. Marindin, assistant, United States Coast and Geodetic Survey, and J. A. Ockerson.

The report of the Commission upon the operations under its charge during the fiscal year ending June 30, 1903, was submitted to the Secretary of War September 16, 1903, and is printed in a supplement to this report.

Estimates for the fiscal year ending June 30, 1905.—The following estimates of funds required for carrying on the works under its charge for the year ending June 30, 1905, are submitted by the Commission:

For continuing the improvement of the Mississippi River from Head of Passes to the mouth of the Ohio River, including salaries and clerical, office, traveling, and miscellaneous expenses of the Mississippi River Commission	\$2,000,000
Improving harbor at Memphis, Tenn. (including Wolf River)	75,000
Improving harbors at Natchez, Miss., and Vidalia, La	150,000
Rectification of Red and Atchafalaya rivers, Louisiana	20,000
Improving harbor at New Orleans, La	300,000
Total	2,545,000

PERMANENT INTERNATIONAL COMMISSION OF CONGRESSES OF NAVIGATION.

By act approved June 28, 1902, Congress appropriated the sum of \$3,000 per year for the support and maintenance of the Permanent International Commission of Congresses of Navigation, and for the payment of the actual expenses of the properly accredited National

delegates of the United States to the meeting of the congresses and of the Commission.

The ninth international congress of navigation was held at Düsseldorf, Germany, in June, 1902. Three delegates were appointed to represent the United States, namely, Lieut. Col. C. W. Raymon, Corps of Engineers, and Messrs. B. M. Harrod and John Bogart, civil engineers. Lieutenant-Colonel Raymond and Mr. Bogart attended the congress.

The United States is represented on the Permanent International Commission of Congresses of Navigation, and on the permanent executive committee of that Commission, Lieutenant-Colonel Raymond being the principal representative, and Mr. E. L. Corthell, C. E., the substitute. Lieutenant-Colonel Raymond attended a meeting of the Commission held at Brussels, Belgium, on June 8, 1903.

The expenditures during the year from the appropriation made by Congress have been for the expenses of the properly accredited National delegates to the meeting of the congress and of the Permanent International Commission, and for the support and maintenance of the Commission, to which the United States contributes \$1,000 per annum.

ESTABLISHMENT OF HARBOR LINES.

Under authority given to the Secretary of War in section 11 of the river and harbor act approved March 3, 1899, harbor lines have been established during the past fiscal year at the following localities, details of which will be found in the reports of the local officers:

Lermonds Cove, Rockland Harbor, Maine; New Bedford Harbor, including Fairhaven, Mass.; Pawtucket (Seekonk) and Providence rivers, Providence Harbor, Rhode Island; Hudson River at Albany, N. Y.; Hudson River, western shore, from Fort Lee to Guttenberg, N. J.; East River, New York, at North Brother Island; East River, New York, at Lawrence Point and Berrian Island; East River, New York, westerly side, between East Thirteenth and East Eighteenth streets; east branch of Newtown Creek at Brooklyn, N. Y.; Delaware River, between Edgemoor and mouth of Christiana River; Patapsco River at Sparrow Point, Baltimore Harbor, Maryland; Smith Creek, Norfolk Harbor, Virginia, and Elizabeth River, Norfolk Harbor, at the Atlantic City bridge, at mouth of Smith Creek; Trent River at Newbern, N. C.; St. Johns River at Jacksonville, Fla.; Mississippi River at and near St. Louis, Mo.; Mississippi River at St. Paul, Minn.; Monongahela River, between Wilson and Elizabeth, Pa.; Monongahela River at Hazelwood, Pittsburg Harbor, Pennsylvania; Monongahela and Allegheny rivers, Pittsburg, Pa.; Allegheny River at Pittsburg, Pa.; Duluth Harbor, Minnesota; Fox River at Oshkosh, Wis.; Fox River at Green Bay, Wis.; Maumee River, Toledo Harbor, Ohio; San Francisco Harbor, California.

CHICAGO DRAINAGE CANAL.

On May 8, 1899, the Secretary of War granted a conditional permit to the Sanitary District of Chicago to connect its artificial channel with the Chicago River and cause the waters of said river to flow into the canal. The rate of flow has been modified from time to time as required in the interests of navigation.

WATER-POWER CANAL OF THE MICHIGAN LAKE SUPERIOR POWER COMPANY AT SAULT STE. MARIE, MICH.

Pursuant to a provision in the river and harbor act of June 13, 1902, the Secretary of War, under date of December 12, 1902, approved plans submitted by the Michigan Lake Superior Power Company for its water-power canal and remedial works, and gave his consent to the diversion of the water from the St. Marys River, as authorized by said act, subject to certain conditions which were formally accepted by the company.

CONSTRUCTION OF LOCK AND DAM IN MERMENTAU RIVER, LOUISIANA, BY THE RICE IRRIGATION AND IMPROVEMENT ASSOCIATION OF THE STATE OF LOUISIANA.

Act of Congress approved January 10, 1903, authorizes the Rice Irrigation and Improvement Association of the State of Louisiana to construct, at its own expense, a lock or locks and a dam or dams in Mermentau River, Louisiana, near its mouth, upon plans and specifications to be approved by the Secretary of War. Plans and specifications with map of location were duly furnished by the association for consideration by the Department, and were approved by the Secretary of War March 12, 1903.

CONSTRUCTION OF LOCK AND DAM IN BAYOU LAFOURCHE, LOUISIANA, BY THE ATCHAFALAYA BASIN AND LAFOURCHE BASIN LEVEE BOARDS OF THE STATE OF LOUISIANA.

The river and harbor act of June 13, 1902, directs an examination and survey for a lock and dam at the head of Bayou Lafourche, Louisiana, to be constructed by the Atchafalaya Basin and Lafourche Basin levee boards of the State of Louisiana, at their expense, and in accordance with plans and specifications to be approved by the Secretary of War. After consideration of plans and specifications, with map of location of proposed structures, the Secretary of War, by instrument dated December 17, 1902, granted permission under certain stipulated conditions for construction of a temporary dam, and approved conditionally the plans for the proposed lock.

RULES AND REGULATIONS GOVERNING THE NAVIGATION OF CANALS, ETC., AND THE OPENING OF DRAWBRIDGES.

Rules and regulations for the navigation of canals and similar works of navigation.—Section 4, of the river and harbor act of August 18, 1894, as amended by section 11 of the river and harbor act of June 13, 1902, delegates to the Secretary of War the duty of prescribing such rules and regulations for the use, administration, and navigation of any or all canals and similar works of navigation that now are or that hereafter may be owned, operated, or maintained by the United States, as in his judgment the public necessity may require; and he is also authorized to prescribe regulations to govern the speed and movement of vessels and other water craft in any public navigable channel which has been improved under authority of Congress, whenever, in his judgment, such regulations are necessary to protect such improved channels from injury, or to prevent interference with the operations of the United States in improving navigable waters, or injury to any plant

that may be employed in such operations. Such rules and regulations have been established during the past year for the following-named works:

Baltimore Harbor, Maryland; South Pass, Mississippi River (modification); Monongahela River, Pennsylvania; Huron, Lorain, Cleveland, Fairport, Ashtabula, and Conneaut harbors, Ohio; Buffalo and Charlotte harbors, New York.

Rules and regulations governing the opening of drawbridges.—Section 5 of the river and harbor act of August 18, 1894, provides that it shall be the duty of all persons owning, operating, and tending the drawbridges now built, or which may hereafter be built, across the navigable rivers and other waters of the United States, to open, or cause to be opened, the draws of such bridges under such rules and regulations as in the opinion of the Secretary of War the public interests require for the passage of vessels and other water craft. Such rules and regulations have been established during the past year by the Secretary of War for certain drawbridges over the following-named waterways:

Mystic River, Massachusetts, Chelsea Bridge; Lake Worth channel, Florida; St. Johns River, St. Lucie (St. Lucia) River, Sebastian River, Jupiter River, and Miami River, Florida; Mackeys Creek, North Carolina.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Plans and maps of locations of the following bridges, proposed to be erected under the authority of special acts of Congress, have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War, as provided by the acts; and the local engineer officers have been furnished with copies of the instruments of approval and drawings showing plans and locations, and charged with the supervision of the construction of the bridges so far as necessary to see that they are built in accordance with the approved plans:

1. *Bridge of the Newport Bridge, Belt and Terminal Railway Company over White River at Newport, Ark.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved June 21, 1902, were approved by the Secretary of War July 8, 1902.

2. *Bridge of the Omaha Bridge and Terminal Railway Company over Missouri River between Council Bluffs, Iowa, and East Omaha, Nebr.*—Plans for a temporary bridge at this place were approved by the Secretary of War May 9, 1893 (see Annual Report of the Chief of Engineers for 1893, p. 465).

Plans for replacing this bridge with a permanent structure under authority of an act of Congress approved May 23, 1902, were approved by the Secretary of War July 10, 1902.

3. *Bridge of the city of Little Falls, Minn., over Mississippi River.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved June 30, 1902, were approved by the Secretary of War July 10, 1902.

4. *Bridge of the Ozark and Cherokee Central Railway Company across Arkansas River, near Fort Gibson, Ind. T.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved February 24, 1902, were approved by the Secretary of War July 17, 1902.

5. *Bridge of the Tennessee Central Railroad Company over Emory River at Harriman, Tenn.*—The construction of this bridge was authorized by act of Congress approved June 30, 1902. Plans and map of location were approved by the Secretary of War July 30, 1902.

6. *Bridge of the Minneapolis, Superior, St. Paul and Winnipeg Railway Company over Mississippi River at Anoka, Minn.*—The construction of this bridge was authorized by an act of Congress approved June 27, 1902. Plans and map of location were approved by the Secretary of War August 5, 1902.

7. *Bridge of the Memphis, Helena and Louisiana Railway Company across White River, between the counties of Arkansas and Desha, Ark.*—Plans and map of location of a bridge proposed to be built at this locality under authority of an act of Congress approved February 24, 1902, were approved by the Secretary of War August 14, 1902.

8. *Bridge of the Memphis, Helena and Louisiana Railway Company across Arkansas River, between the counties of Arkansas and Desha, Ark.*—Plans and map of location for a bridge proposed to be built at this locality under authority of an act of Congress approved February 24, 1902, were approved by the Secretary of War August 14, 1902.

9. *Bridge of the Nashville Terminal Company over Cumberland River in Davidson County, Tenn.*—The construction of this bridge was authorized by an act of Congress approved June 18, 1902. Plans and map of location were approved by the Secretary of War August 18, 1902.

10. *Bridge of the Eldorado and Bastrop Railway Company over Ouachita River between Ashley and Union counties, Ark.*—The construction of this bridge was authorized by an act of Congress approved March 24, 1902. Plans and map of location were approved by the Secretary of War October 9, 1902.

11. *Bridge of the United States and West Indies Railroad and Steamship Company over Manatee River at Craigs Point, Florida.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved May 7, 1902, were approved by the Secretary of War November 19, 1902.

12. *Bridge of the Shreveport Bridge and Terminal Company across Red River near Shreveport, La.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved April 30, 1902, were approved by the Secretary of War November 19, 1902.

13. *Bridge of the Shreveport and Red River Valley Railway Company across Red River between Alexandria and Pinerille, La.*—Plans for the construction of a bridge at this place were approved by the Secretary of War June 15, 1900 (see Annual Report of the Chief of Engineers for 1900, p. 698). Plans for certain protection work for the drawspan of said bridge were approved by the Secretary of War December 11, 1902.

14. *Government highway bridge across Potomac River between Long Bridge and Aqueduct Bridge, Washington, D. C.*—The construction of this bridge was provided for by act of Congress approved February 12, 1901, as amended by act approved July 1, 1902. The location of the structure was approved by the Secretary of War August 1, 1902, and the plans for its construction were approved by him January 13, 1903.

15. *Bridge of the New York, Chicago and St. Louis Railroad Com-*

pany, across Calumet River at Cummings, Ill.—Plans and map of location of a bridge to replace the existing structure at this place, under authority of an act of Congress approved July 1, 1902, were approved by the Secretary of War January 15, 1903.

16. *Bridge of the Western Bridge Company across Ohio River between the city of Allegheny and the borough of McKees Rocks, Pa.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved April 30, 1902, were approved by the Secretary of War February 5, 1903.

17. *Bridge of the Alexandria and Pineville Bridge Company across Red River between Alexandria and Pineville, La.*—Plans for the construction of a bridge at this place were approved by the Secretary of War August 8, 1900 (see Annual Report of the Chief of Engineers for 1901, p. 659.) Plans for certain protection work for the drawspan of said bridge were approved by the Secretary of War February 9, 1903.

18. *Bridge of the White River Railway Company over White River, Arkansas.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved May 3, 1902, were approved by the Secretary of War February 13, 1903.

19. *Bridge of the Ashland and Ironton Bridge Company across Ohio River between Ironton, Ohio, and Ashland, Ky.*—Plans for the construction of a bridge at this place were approved by the Secretary of War April 22, 1901 (see Annual Report of the Chief of Engineers for 1901, p. 660). The work of construction not having been commenced within the limit of time prescribed by section 4 of the river and harbor act of July 13, 1892, the approval of the Secretary of War became null and void. The plans were reapproved by the Secretary of War February 16, 1903.

20. *Bridge of the Knoxville, Lafollette and Jellico Railroad Company over Clinch River at or near Dossett, Tenn.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved February 3, 1903, were approved by the Secretary of War March 14, 1903.

21. *Bridge of Mr. A. R. Vanmatre over St. Francis River at or near St. Francis, Ark.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved March 3, 1903, were approved by the Secretary of War March 26, 1903.

22. *Bridge of the Memphis, Helena and Louisiana Railway Company over St. Francis River in Lee County, Ark.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved February 18, 1903, were approved by the Secretary of War April 20, 1903.

23. *Bridge of the Plattsmouth Pontoon Bridge Company over Missouri River between Cass County, Nebr., and Mills County, Iowa.*—The construction of this bridge was authorized by an act of Congress approved June 28, 1902. Plans and map of location were approved by the Secretary of War April 30, 1903.

24. *Bridge of the Connecticut River Bridge and Highway District over Connecticut River at Hartford, Conn.*—Plans and map of location of a bridge proposed to be built at this place under authority of an act of Congress approved February 18, 1903, were approved by the Secretary of War May 21, 1903.

25. *Bridge of the Steubenville Bridge Company over Ohio River between Steubenville, Ohio, and Cross Creek Township, W. Va.*—Plans

and map of location of a bridge proposed to be built at this place were duly considered by a Board of Engineers pursuant to law (acts of Congress of December 17, 1872, and February 14, 1883), and were approved by the Secretary of War June 29, 1903.

Under the provisions of section 9 of the river and harbor act approved March 3, 1899, bridges may be built over navigable waters entirely within the limits of any State, under the authority of legislative enactment of such State, when the plans and locations of the structures are approved by the Secretary of War. Plans and maps of locations of the following bridges proposed to be erected under these provisions have been examined with a view to protection of the interests of navigation, and have been approved by the Secretary of War; and the local engineer officers have been furnished with copies of the drawings and instruments of approval, and charged with the supervision of construction of the bridges so far as necessary to see that they are built in accordance with the approved plans.

1. *Bridge of the Wisconsin Central Railway Company over Fox River at Oshkosh, Wis.*—Plans for construction of a bridge at this place to replace an existing structure were approved by the Secretary of War July 2, 1902.

2. *Bridge of the Alabama and Mississippi Railroad Company over Chickasaw River at Leakesville, Miss.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War July 16, 1902.

3. *Bridge of the Northern Pacific Railway Company over Deschutes River at Olympia, Wash.*—Plans for rebuilding the existing structure at this place were approved by the Secretary of War July 16, 1902.

4. *Bridge of the New York, Chicago and St. Louis Railroad Company over Black River at Lorain, Ohio.*—Plans for a bridge proposed to be built at this place to replace an existing structure were approved by the Secretary of War July 17, 1902.

5. *Bridge of the Kentucky Lumber and Veneer Company across North Fork of Kentucky River, below Jackson, Ky.*—Plans for construction of a bridge at this place were approved by the Secretary of War June 5, 1902. (See Annual Report of the Chief of Engineers for 1902, p. 589.) Modified plans providing for certain changes in the construction of the substructure were approved by the Secretary of War July 25, 1902.

6. *Bridge of the Seattle and Renton Railway Company over Black River, in King County, Wash.*—Plans and map of location of a bridge to replace an existing structure over this stream were approved by the Secretary of War August 5, 1902.

7. *Bridge of the Illinois Central Railroad Company over Pass Manchac, in St. John the Baptist Parish, La.*—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War August 5, 1902.

8. *Bridge of the Northern Pacific Railway Company over the Lake Washington Canal right of way at Seattle, Wash.*—Plans and map of location for a bridge proposed to be built at this place were approved by the Secretary of War August 5, 1902.

9. *Bridge of Colleton County, S. C., over Wallace Creek.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 8, 1902.

10. *Bridge of the Seattle and Montana Railroad Company over the I*

and *J street waterway at Whatcom, Wash.*—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War August 21, 1902.

11. *Bridge of Sacramento and San Joaquin counties, Cal., over Mokelumne River, near mouth of Snodgrass Slough.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War August 25, 1902.

12. *Bridge of Dyer County, Tenn., over Obion River, near Burnt Mills.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War September 19, 1902.

13. *Bridge of Alameda County, Cal., over the channel connecting San Leandro Bay with San Francisco Bay, between Alameda and Bay Farm Island.*—Plans for a bridge to replace the existing structure at this place were approved by the Secretary of War September 22, 1902.

14. *Bridge of the city of Appleton, Wis., across Fox River at John street.*—Plans for rebuilding the existing structure at this place were approved by the Secretary of War September 24, 1902.

15. *Bridge of Catahoula Parish, La., over Bayou Louis.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War September 27, 1902.

16. *Bridge of the Kansas City Southern Railway Company over Little River, near White Cliffs, Ark.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 10, 1902.

17. *Bridge of the Northern Pacific Railway Company over Lake Pend Oreille, in Kootenai County, Idaho.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 10, 1902.

18. *Bridge of the city of Chicago, Ill., over North Branch of Chicago River at Western avenue.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 11, 1902.

19. *Bridge of Lincoln County, W. Va., over Guyandot River.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 13, 1902.

20. *Bridge of Dade County, Fla., over Miami River at Avenue D, Miami.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 15, 1902.

21. *Bridge of the city of Grand Rapids, Mich., over Grand River at Wealthy avenue.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 16, 1902.

22. *Bridge of the Southern Railway Company over Wateree River, near Kingsville, S. C.*—Plans for reconstruction of the existing bridge at this place were approved by the Secretary of War October 16, 1902.

23. *Bridge of the Philadelphia, Bristol and Trenton Street Railway Company over Neshaminy Creek, near Croydon, Pa.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 17, 1902.

24. *Bridge of the city of Chicago, Ill., over South Branch of Chicago River at Randolph street.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 20, 1902.

25. *Bridge of the city of Chicago, Ill., over Chicago River at State*

street.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 20, 1902.

26. *Bridge of the Michigan Central Railroad Company over Little Calumet River, Illinois.*—Plans for rebuilding the bridge at this place were approved by the Secretary of War October 28, 1902.

27. *Bridge of the Big Sandy Railway Company (Chesapeake and Ohio Railway Company) over Levisa Fork of Big Sandy River near Whitehouse, Ky.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 28, 1902.

28. *Bridge of the city of Chicago, Ill., over South Fork of South Branch of Chicago River at Archer avenue.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War October 30, 1902.

29. *Bridge of the Seattle and Montana Railroad Company over Whatcom Creek Waterway at Whatcom, Wash.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War November 5, 1902.

30. *Bridge of Pacific County, Wash., over Chinook River.*—Plans and map of location of a bridge proposed to be built across this stream were approved by the Secretary of War November 5, 1902.

31. *Bridges of the city of Cleveland, Ohio, over Cuyahoga River at Jefferson street.*—Plans for improvement of Cuyahoga River at this place, involving the reconstruction of the existing bridge and the erection of a new bridge, were approved by the Secretary of War December 16, 1902, under the provisions of section 1 of the river and harbor act of 1899.

32. *Bridge of Lee County, Fla., over Caloosahatchee River, at Ferry Crossing, Alva., Fla.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War December 18, 1902.

33. *Bridge of Calcasieu Parish, La., over English Bayou.*—Plans and map of a location of bridge proposed to be built at this place were approved by the Secretary of War December 24, 1902.

34. *Bridge of Mr. J. E. Terry over Sacramento River, California.*—Plans and map of location of a bridge proposed to be built across this river were approved by the Secretary of War December 27, 1902.

35. *Bridge of the Pleasantville and Atlantic Turnpike or Plank Road Company over Beach Thoroughfare at Atlantic City, N. J.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 5, 1903.

36. *Bridge of the Atchison, Topeka and Santa Fe Railway Company over Illinois River near Chillicothe, Ill.*—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War January 7, 1903.

37. *Bridge of Burlington County, N. J., across Rancocas River at Hainesport.*—Plans of the Burlington County Traction Company for rebuilding the existing structure at this place were approved by the Secretary of War January 10, 1903.

38. *Bridge of Venango County, Pa., over Allegheny River at Kennerdell.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 13, 1903.

39. *Bridge of the Galveston, Harrisburg and San Antonio Railway*

Company over Brays Bayou at Harrisburg, Tex.—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 13, 1903.

40. *Bridges of the Shreveport and Red River Valley Railway Company over Bayou des Glaisses in Avoyelles Parish, La.*—Plans and maps of location of these bridges were approved by the Secretary of War January 23, 1903.

41. *Bridge of the Market Street Elevated Passenger Railway Company over Schuylkill River at Market street, Philadelphia, Pa.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 30, 1903.

42. *Bridge of the Houston, Beaumont and New Orleans Railroad Company over Trinity River, Tex.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War January 30, 1903.

43. *Bridge of the Jackson, Lansing and Saginaw Railroad (Michigan Central Railroad) Company over Indian River, Michigan.*—Plans for rebuilding the bridge at this place were approved by the Secretary of War January 30, 1903.

44. *Bridge of the Southern Pacific Company over Mormon channel at Stockton, Cal.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 3, 1903.

45. *Bridge of the Chicago, Burlington and Quincy Railway Company over Wisconsin River at Prairie du Chien, Wis.*—Plans for reconstruction of the existing bridge at this place were approved by the Secretary of War February 3, 1903.

46. *Bridge of the Houston, Beaumont and New Orleans Railroad Company over San Jacinto River, Texas.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 4, 1903.

47. *Bridge of Mr. D. M. Eddy over Conclitz River at Castlerock, Wash.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 6, 1903.

48. *Bridge of Tender County, N. C., across Black River at Still Bluff, N. C.*—Plans for the construction of a bridge at this place were approved by the Secretary of War July 5, 1900 (see Annual Report of the Chief of Engineers for 1901, p. 661). Modified plans were approved by the Secretary of War February 6, 1903.

49. *Bridge of the city of Tacoma, Wash., across Puyallup River at South Twenty-first street.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 9, 1903.

50. *Bridge of the Southern Pacific Company on the line of the Louisiana Western Railroad over Calcasieu River, Louisiana.*—Plans for reconstruction of the existing bridge at this place were approved by the Secretary of War February 10, 1903.

51. *Bridge of the Florida East Coast Railway Company over Miami River, at Miami, Fla.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 11, 1903.

52. *Bridges of Atlantic County, N. J., over Lakes Ditch and Beach Thoroughfare, at Atlantic City, on the line of the new highway from Pleasantville to Atlantic City.*—Plans and map of location of two

bridges proposed to be built at these localities were approved by the Secretary of War February 13, 1903.

53. *Bridge of the Western Maryland Tidewater Railroad Company over Middle Branch of Patapsco River, Spring Garden, Baltimore, Md.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 13, 1903.

54. *Bridge of Braxton County, W. Va., over Little Kanawha River at Hyers Run.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War February 21, 1903.

55. *Bridges of the Western Pennsylvania Railroad Company over the back channel of Allegheny River at Herr Island, Pa.*—Plans and maps of location of a temporary and two permanent bridges at this locality were approved by the Secretary of War August 29, 1902, September 19, 1902, and March 9, 1903, respectively.

56. *Bridges of the city of Chicago, Ill., over South Branch of Chicago River at Eighteenth street and at Loomis street.*—Plans for reconstructing existing bridges at these points were approved by the Secretary of War March 7, 1903.

57. *Bridge of the Pennsylvania Railroad Company over Allegheny River at Brilliant Station, Pittsburg, Pa.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War March 11, 1903.

58. *Bridge of the city of Milwaukee, Wis., over Menominee River at West Water street.*—Plans for rebuilding the existing structure at this place were approved by the Secretary of War March 13, 1903.

59. *Bridge of the Chicago, Milwaukee and St. Paul Railway Company over Menominee River at West Water street, Milwaukee, Wis.*—Plans for rebuilding the existing structure at this place were approved by the Secretary of War March 13, 1903.

60. *Bridge of the Grand River Toll Bridge Company over Grand River between Spring Lake and Grand Haven, Mich.*—Plans for a bridge to replace an existing structure at this place were approved by the Secretary of War March 25, 1903.

61. *Bridge of Clatsop County, Oreg., across Lewis and Clark River near its mouth.*—Plans and map of location for a bridge proposed to be built at this locality were approved by the Secretary of War March 25, 1903.

62. *Bridge of the Florida Southern Railroad Company over Caloosahatchee River at Beautiful Island, Florida.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 6, 1903.

63. *Bridge of Leon County, Fla., over Ocklockonee River.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 8, 1903.

64. *Bridge of the Maine Central Railroad Company (Knox and Lincoln Branch) over Marsh River at Newcastle, Me.*—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War April 8, 1903.

65. *Bridge of The United Railways and Electric Company of Baltimore, Md., over Back River, Maryland.*—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War April 10, 1903.

66. *Bridge of the Philadelphia, Baltimore and Washington Rail-*

road Company over Brandywine Creek at Wilmington, Del.—Plans for rebuilding the existing bridge at this place were approved by the Secretary of War April 13, 1903.

67. *Bridge of the Wisconsin Central Railway Company across the slough between Boom Island and the east bank of Mississippi River at Fifth avenue, Minneapolis, Minn.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War April 14, 1903.

68. *Bridge of Washington Parish, La., over Bogue Chitto at Franklinton, La.*—Plans for a bridge to replace the existing structure at this place were approved by the Secretary of War April 16, 1903.

69. *Bridges of the Little Kanawha Railroad Company over Little Kanawha River in Wirt, Calhoun, Gilmer, and Braxton counties, W. Va.*—Plans and maps of location of seven bridges proposed to be built over this stream were approved by the Secretary of War May 1, 1903.

70. *Bridge of the State of Massachusetts over Malden River between Everett and Medford, Mass.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War May 1, 1903.

71. *Bridge of the Metropolitan Park Commission of Massachusetts across Saugus River between Revere and Lynn, Mass.*—Plans for the construction of a bridge at this place were approved by the Secretary of War March 16, 1899 (see Annual Report of the Chief of Engineers for 1899, p. 622). Modified plans were approved by the Secretary of War May 6, 1903.

72. *Bridge of the St. Mary Park Association over Bayou Teche at Franklin, La.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War, November 20, 1902. Modified plans subsequently submitted were approved by the Secretary of War May 7, 1903.

73. *Bridge of the Louisiana and Arkansas Railroad Company over Little River between Grant and Catahoula parishes near Simmons Ferry, La.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War May 9, 1903.

74. *Bridge of the city of New York over East Chester Bay in Pelham Bay Park.*—Plans for a bridge to replace an existing structure at this place were approved by the Secretary of War May 18, 1903.

75. *Bridge of the Conway and Seashore Railroad Company over Waccamaw River at Conway, S. C.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War June 22, 1903.

76. *Bridges of the Newburgh and South Shore Railway Company over Cuyahoga River at Cleveland, Ohio.*—Plans and maps of location of two bridges proposed to be built over this stream were approved by the Secretary of War June 25, 1903.

77. *Bridge of the Jersey Central Traction Company over Cheesequake Creek, New Jersey.*—Plans and map of location of a bridge proposed to be built at this place were approved by the Secretary of War June 27, 1903.

Under the provisions of section 18 of the river and harbor act approved March 3, 1899, relating to bridges obstructing navigation, plans for alteration of the following bridges, so as to render naviga-

tion through or under them reasonably free, easy, and unobstructed, have been examined and approved by the Secretary of War, and the local engineer officers have been furnished with copies of the plans and instruments of approval and charged with supervision of the work of alteration so far as necessary to see that the approved plans are complied with:

1. *Bridge of Venango County, Pa., over Allegheny River at Franklin, Pa.*—The existing bridge at this place being an obstruction to navigation, and plans for its reconstruction having been voluntarily presented, they were approved by the Secretary of War July 21, 1902.

2. *Bridge of the Northern Pacific Railway Company over Hump-tulips River, Washington.*—Reconstruction of this bridge being necessary in the interests of navigation, and plans for its reconstruction having been presented, they were approved by the Secretary of War March 30, 1903.

3. *Bridge of the Big Rock Bridge Company (Big Rock Bridge) over Allegheny River, near Franklin, Pa.*—The existing bridge at this place being obstructive to navigation, and plans for its reconstruction having been presented by the company, they were approved by the Secretary of War May 6, 1903.

4. *Bridge of Marion County, W. Va., over Monongahela River at Fairmont.*—The existing bridge at this place being an obstruction to navigation, and plans for its reconstruction having been presented, they were approved by the Secretary of War May 26, 1903.

BRIDGES OBSTRUCTING NAVIGATION.

Under the requirements of section 18 of the river and harbor act approved March 3, 1899, the Secretary of War notified the persons, corporations, or associations owning or controlling certain bridges obstructing navigation, after giving them a reasonable opportunity to be heard, to so alter said bridges as to render navigation through or under them reasonably free, easy, and unobstructed, specifying in the notice the alterations required to be made and prescribing a reasonable time in which to make them, as follows:

1. *Bridge of Atlantic County, N. J., over Patcong Creek at Steel-manville.*—Notice dated June 22, 1903, served on the board of free-holders July 7, 1903. Specified alterations to be completed on or before September 3, 1903.

2. *Bridge of the city of New Haven and the town of Orange, Conn., over West River at Kimberly avenue.*—Notices dated October 4, 1899, requiring certain alterations in this bridge were served on the proper officials October 12 and 14, 1899, respectively (see Annual Report of the Chief of Engineers for 1900, p. 702).

Subsequently, the Secretary of War decided to modify the order with respect to alterations required, and new notices dated March 25, 1903, were served on the mayor of the city and the selectmen of the town April 11, 1903. Specified alterations to be completed within one year from the date of service of notice.

3. *Bridge of the Union Bridge Company (Union Bridge) over Allegheny River between Pittsburg and Allegheny, Pa.*—Notice dated January 20, 1903, served on the company January 26, 1903. Specified alterations to be completed within eighteen months from the date of service of notice.

4. *Bridge of the Central of Georgia Railway Company over St. Augustine Creek, Georgia, on the line of the Savannah and Tybee Railroad.*—Notice dated August 28, 1902, served on the company October 23, 1902. Specified alterations to be completed within three months from the date of service of notice.

5. *Bridges of the Carrabelle, Tallahassee and Georgia Railroad Company over Ocklockonee and Sopchoppy rivers, near Sopchoppy, Fla.*—Notices dated November 25, 1902, served on the company December 23, 1902. Specified alterations to be completed within two months from the date of service of notices.

6. *Bridge of the city of Boston, Mass. (Congress Street Bridge), over Fort Point channel, Boston Harbor.*—Notice dated December 27, 1902, served on the mayor January 3, 1903. Specified alterations to be completed on or before December 31, 1903.

7. *Bridge of the city of Boston, Mass. (Mount Washington Avenue Bridge), over Fort Point channel, Boston Harbor.*—Notice dated December 27, 1902, served on the mayor January 3, 1903. Specified alterations to be completed on or before December 31, 1903.

8. *Bridge of the Central Vermont Railway Company and the New London Northern Railroad Company over Smiths Cove of Thames River, near New London, Conn.*—Notices dated May 11, 1903, served on the officials of the respective companies June 17 and 18, 1903. Specified alterations to be completed within thirty days from the date of service of notice.

9. *Bridge of Pamlico County, N. C., over Bay River at Bayboro.*—Notice dated September 24, 1902, served on the chairman board of commissioners October 4, 1902. Specified alterations to be completed on or before November 1, 1902.

10. *South End Bridge over Connecticut River between Springfield and Agawam, Mass.*—Notices dated August 22, 1902, served on the city and town officials September 15, 1902, and on the officials of Hampden County, September 16, 1902. Specified alterations to be completed within six months from the date of service of notice.

11. *Bridge of the Washington County Railroad Company over the channel between Point Pleasant and Carbons Island, Maine.*—Notice dated April 20, 1903, served on the company April 30, 1903. Specified alterations to be completed on or before December 31, 1904.

12. *Bridge of the town of Bristol, Me., over the "Gut" at South Bristol, Me.*—Notice dated August 23, 1902, served on the chairman board of selectmen August 30, 1902. Specified alterations to be completed on or before July 30, 1903.

MISCELLANEOUS.

[Public works not provided for in acts making appropriations for the construction, repair, and preservation of works on rivers and harbors.]

BRIDGES AT WASHINGTON, D. C.

Operations under this head were in the charge of Lieut. Col. Chas. J. Allen, Corps of Engineers.

1. *Repair of the Aqueduct Bridge across Potomac River.*—(a) *Pier No. 5.*—Some necessary examination of Pier No. 5 and soundings of the river at the site were made during the year.

The District of Columbia appropriation act, approved July 1, 1902, contained the following item:

Repairs to Aqueduct Bridge: For construction of pier numbered five of the Aqueduct Bridge across the Potomac River at Georgetown, District of Columbia, to be expended under the direction of the Secretary of War, sixty-five thousand dollars.

A contract was made April 22 last for the reconstruction of Pier No. 5.

Amount appropriated by act of July 1, 1902.....	\$65,000.00
June 30, 1903, amount expended during fiscal year	1,146.16
July 1, 1903, balance unexpended	63,853.84
July 1, 1903, outstanding liabilities	25.00
July 1, 1903, balance available.....	63,828.84
July 1, 1903, amount covered by uncompleted contracts.....	54,956.00

(b) *Repair of piers.*—Congress, by joint resolution approved July 1, 1902, enacted as follows:

That the Secretary of War be, and he is hereby, authorized to spend an amount not exceeding three thousand dollars from the balance of appropriations made for the reconstruction of pier number four of the Aqueduct Bridge, District of Columbia, for the purpose of the examination of, and immediate temporary repairs to, the remaining piers of said bridge in cases of need arising from flood or ice.

July 1, 1903, amount available (joint resolution July 1, 1902) \$3,000.00

PIER NO. 4.

July 1, 1902, balance unexpended	\$15,477.96
Amount diverted by joint resolution July 1, 1902, for repair of piers.....	3,000.00

July 1, 1903, balance unexpended

(See Appendix C C C 1.)

2. *Memorial Bridge.*—There are no operations to report under this head, no appropriation having ever been made for erecting this proposed bridge. For fuller information reference is made to the Annual Report for 1902, page 591.

July 1, 1902, balance unexpended	\$219.95
June 30, 1903, amount expended during fiscal year	1.00

July 1, 1903, balance unexpended (deposited in Treasury) 218.95

(See Appendix C C C 2.)

3. *Highway bridge over Potomac River at Washington, D. C.*—Section 12 of an act of Congress approved February 12, 1901, provides for the construction of a highway bridge to replace the existing Long Bridge.

By authority of the Secretary of War a Board of Engineers was constituted to select a site and to formulate plans, specifications, and estimates for the bridge. The Board submitted report, dated October 25, 1901, which was transmitted to Congress for its information. It is printed in House Document No. 138, Fifty-seventh Congress, first session, and also in Appendix B B B 3 of the Annual Report of the Chief of Engineers for 1902.

The sum appropriated by the act was \$568,000.

The Board presented two plans, one for \$575,000, which it did not regard as satisfactory, it not providing sufficient accommodation, and another, but of sufficient accommodation, for \$996,000.

Congress, by act of July 1, 1902 [Public—No. 218], increased the appropriation to \$996,000, in the following words:

Highway bridge across Potomac River: Section twelve of the "Act to provide for eliminating certain grade crossings on the line of the Baltimore and Potomac Railway Company in the city of Washington, District of Columbia, and requiring said company to depress and elevate its tracks, and to enable it to relocate parts of its railroad therein, and for other purposes," approved February twelfth, nineteen hundred and one, is hereby amended by striking out therefrom the words "two years" and inserting in lieu thereof the words "four years," and the limit of cost for the bridge across the Potomac River therein provided for of five hundred and sixty-eight thousand dollars is hereby increased to nine hundred and ninety-six thousand dollars. And the Secretary of War is authorized to enter into a contract or contracts for the construction of said bridge within the said limit of cost. The cost of maintaining in good condition the asphalt paving between the street-railway tracks and two feet outside thereof on said bridge shall be paid by the street railway company or companies using the same, under such regulations as the Commissioners of the District of Columbia shall prescribe: *Provided*, That all street railroads chartered or that may hereafter be chartered by Congress shall have the right to cross said bridge upon terms mutually agreed upon with the Washington, Alexandria and Mount Vernon Railway Company, or, in case of disagreement, upon terms determined by the supreme court of the District of Columbia, which is authorized and directed to give hearing to the interested parties and to fix the terms of joint trackage.

Work upon the proposed structure had not begun at the close of the fiscal year.

Amount appropriated by act of July 1, 1902.....	\$996, 000. 00
Amount expended to June 30, 1903.....	a 9, 530. 93

July 1, 1903, balance unexpended.....	986, 469. 07
July 1, 1903, outstanding liabilities.....	150. 00

July 1, 1903, balance available	986, 319. 07
---------------------------------------	--------------

(See Appendix C C C 3.)

MAINTENANCE AND REPAIR OF THE WASHINGTON AQUEDUCT; INCREASING THE WATER SUPPLY OF WASHINGTON, D. C., AND WASHINGTON AQUEDUCT, DISTRICT OF COLUMBIA, FILTRATION PLANT.

These works were in the charge of Lieut. Col. Alexander M. Miller, Corps of Engineers, having under his immediate orders Lieut. W. P. Wooten, Corps of Engineers.

1. *Washington Aqueduct, District of Columbia.*—The dam at Great Falls was repaired by replacing 1,015 cubic yards of riprap backing that had been carried away by floods. The grounds at the Maryland end of the dam were graded and a new fence erected.

Gatehouses, gate-keepers' houses, and storehouses were put in good repair. The old revolving screen machinery was removed from gatehouse at Georgetown distributing reservoir.

The grounds at the reservoirs were well maintained and necessary repairs made to fences, etc. The grounds at the west shaft gatehouse were graded, sodded, and fenced.

The Conduit road has been kept in good order, and the road between the Club House and Great Falls has been repaired. Over a portion of the by-conduit at Dalecarlia reservoir the earth filling was raised to a grade which prevented overflow from the reservoir.

Repairs were made to bridges where needed and also to telephone line.

^a Of this amount \$5,500 was expended under act of February 12, 1901.

Vaults on pipe lines were cleaned and the valves worked. A valve on the 48-inch main and a break in a 12-inch main were repaired.

During the past year the extreme fluctuation of the water level in Georgetown distributing reservoir was 5.41 feet.

Measurements of the daily and hourly consumption and waste of water were made during ten months and gave an average of 58,237,644 gallons. The consumption and waste, measured on June 25, 1903, were found to be 59,579,900 gallons per diem. This is the largest June measurement ever taken, and, estimating the population of the District of Columbia as 280,463, gives a daily per capita consumption and waste of 212 gallons.

Careful and trustworthy investigations made in various cities in the United States show clearly that a daily per capita consumption of 100 gallons is ample for all domestic, business, and public purposes, and that any considerable increase above this amount must be attributed to waste. This extravagant use of water has become a serious menace to the supply of water by the Washington Aqueduct with its present capacity—76,000,000 gallons—and at the rate of increase the ultimate limit would be reached in about ten years.

The present consumption and waste have also an important bearing on the subject of filtration. A filtration plant has been authorized by Congress and is now being constructed. It is probable that the cost of filtration will be about \$6 per million gallons, or at the present rate of consumption about \$300 per day or \$110,000 annually. This is a large charge and can be reduced only by a reduction in consumption.

In the opinion of the local engineer officer in charge of the aqueduct the existing conditions suggest two remedies—either the reduction of the consumption to a reasonable rate, 100 gallons per capita per diem, by the use of meters, or the increase of the present supply to keep up with the present demand by the building of a second conduit from the Great Falls of the Potomac. The necessary surveys of practicable routes for this conduit should be taken in hand at once, and an estimate for this work is submitted by the officer in charge.

The estimates for the fiscal year ending June 30, 1905, are as follows:

For building combined storehouse and stable at Great Falls	\$3,000.00
For preliminary surveys for additional conduit from Great Falls	8,000.00
For operation, maintenance, and repair of the aqueduct and its accessories, including the Conduit road, the Washington City reservoir, and the Washington Aqueduct tunnel	33,000.00
Total	44,000.00
Amount appropriated by act approved July 1, 1902	33,000.00
June 30, 1903, amount expended during fiscal year	31,911.05
July 1, 1903, balance unexpended	1,088.95
July 1, 1903, outstanding liabilities	1,088.95
Amount that can be profitably expended in fiscal year ending June 30, 1905	44,000.00

(See Appendix D D D 1.)

2. *Increasing the water supply of Washington, D. C.*—This work has been prosecuted under acts making appropriations to provide for the expenses of the District of Columbia. The act approved June 30, 1898, authorized and directed the Secretary of War to resume work on the Washington Aqueduct tunnel and its accessories and the How-

ard University reservoir, in accordance with the plans of the Board of experts as set forth in its report dated January 17, 1896, and the work has been done in accordance with those plans.

During the year the following work has been accomplished:

West shaft gatehouse.—A building was constructed over the shaft and hoisting engine, and crane put up in it for use in cleaning out the tunnel; the grounds around the building were placed in good condition and fenced in.

Foundry Branch shaft.—All surplus machinery, etc., used in the construction of the tunnel and Washington City reservoir were hauled to this shaft and stored in the sheds there.

Rock Creek shaft.—The power house was practically completed and a hoisting engine and crane erected therein to be used in handling material in shaft and pump pit. The centrifugal pumping plant, after repeated tests which were unsatisfactory, was, the necessary changes being made in the engines, finally accepted from the contractors. A dwelling house was built for the watchman in charge of the station, a large water tank erected, and the grounds graded.

Champlain avenue shaft.—The power house was completed and a hoisting engine and crane put in it for handling material. The grounds around the power house were put in good shape and fenced in. The ground between Eighteenth street and this fence, intended for a public park, was improved and walks and a fountain constructed therein.

Washington City reservoir.—The east shaft gatehouse was completed and a hoisting engine and crane erected therein. The grounds pertaining to the gatehouse and power house were graded and sodded and the roads and walks finished. A dwelling house was built for the principal watchman and the old house for the second watchman was repaired. The revetment on west side of reservoir was brought up to grade and repaired on the east side. The ground along the edge of reservoir was graded for a fence and the fence, being erected by contract, is almost completed.

Superstructures were built over the stop-plank chamber at end of circulating conduit and also over the Congressional spring house.

All the various temporary structures used during construction at the shafts and reservoir were removed, with the exception of those at Foundry Branch shaft, in which the surplus machinery, etc., was stored.

The work which has been prosecuted under the heading "Increasing the water supply of Washington, D. C.," has been completed, with the exception of a small part of the work. No further estimate for this work is submitted, the pay of the necessary watchmen being included in the regular Washington Aqueduct estimates.

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$20, 023. 48
Amount appropriated by act approved July 1, 1902	40, 240. 00
Amount appropriated by deficiency act approved July 1, 1902	2, 250. 00
	62, 513. 48
June 30, 1903, amount expended during fiscal year	61, 138. 39
July 1, 1903, balance unexpended	1, 375. 09
July 1, 1903, outstanding liabilities	365. 62
July 1, 1903, balance available	1, 009. 47

IRON FENCE AROUND RESERVOIR.

Amount appropriated by act approved July 1, 1902	\$27,000.00
June 30, 1903, amount expended during fiscal year	9,432.59
July 1, 1903, balance unexpended	17,567.41
July 1, 1903, outstanding liabilities	1,954.54
July 1, 1903, balance available	15,612.87
July 1, 1903, amount covered by uncompleted contracts	8,739.45
Amount (estimated) required for completion of existing project	1,200.00
(See Appendix D D D 2.)	

3. *Washington Aqueduct, District of Columbia, filtration plant.*—By various acts of Congress there has been appropriated for this work the sum of \$1,900,250, and a further expenditure authorized for the same of \$1,568,155, making a total appropriated and authorized of \$3,468,405 with which to carry out the entire project.

With these appropriations the necessary land was acquired, surveys and maps of the ground made, and plans and specifications for a slow sand-filtration plant worked up and contracts for the work of constructing the plant let.

During the year the following progress has been made:

Intake gatehouse.—This building, the foundation for which had been previously constructed, was finished, the superstructure being built of red brick with tile roof.

Filtration gatehouse.—Work on the superstructure of this building, the foundations having been already constructed, was begun during June and is now progressing satisfactorily.

General plans.—On July 12, 1902, advertisement was issued calling for proposals for the different classes of work to be done on the filtration plant. On August 5, 1902, the advertisement and specifications were recalled "in order to take advantage of the most recent improvements in the construction and operation of filters, and to avoid the possibility of subsequent modifications of contracts." A new set of plans and specifications was then prepared under the supervision of Mr. Allen Hazen, consulting expert, and proposals under these asked for by advertisement of December 29, 1902, thirty days' notice being given. The result of this bidding was that the total amount exceeded the amount authorized by law for the work, except for cement which fell within the estimate and was subsequently accepted. New bids were invited, to be opened February 20, 1903, and these again exceeding the amount authorized the matter was laid before Congress, then in session, with recommendation that the amount authorized be increased to \$3,468,405.

By act approved March 3, 1903, this was done, and proposals being again asked for, were opened March 31, 1903, and under these proposals contracts were awarded for the labor and material for the part of the work which the specifications called for.

On May 22, 1903, proposals were opened for furnishing materials not previously contracted for, and contracts for the same awarded.

Work of contractors.—The contractor for the work of excavation began operations during May, 1903, with a small force, and while the work has not progressed as rapidly as desired, due to rainy weather and delay in securing and installing the plant, it is believed that satis-

factory progress will soon be made as at present an extensive plant is being rapidly installed.

Surveying.—On March 1, 1903, a small survey party started to work laying out the lines along which the contractors are to work, and have since been employed laying out lines and grades and making surveys for estimates. When not needed for fieldwork they have been employed in making computations connected with the work.

Field office.—During the month of April a temporary office was constructed, and occupied during May by a field force to look after the construction of the plant.

Preliminary treatment of Potomac water.—On January 12, 1903, there was referred to the officer in charge of the Washington Aqueduct an amendment intended to be proposed by Mr. Dillingham to the bill making appropriations for the expenses of the District of Columbia for the fiscal year ending June 30, 1904, and for other purposes, providing for the preliminary treatment of the Potomac water above the Georgetown distributing reservoir and for improvements to the same.

On February 26, 1903, a report on this subject was made. (See Appendix D D D 3, herewith.)

July 1, 1902, balance unexpended	\$62.25
Amount appropriated by deficiency act approved July 1, 1902	250.00
Amount appropriated by act approved July 1, 1902	600,000.00
Amount appropriated by act approved March 3, 1903	600,000.00
June 30, 1903, amount expended during fiscal year	1,200,312.25
	29,673.70
July 1, 1903, balance unexpended	1,170,638.55
July 1, 1903, outstanding liabilities	4,851.54
July 1, 1903, balance available	1,165,787.01
July 1, 1903, amount covered by uncompleted contracts	1,952,399.00
{ Amount (estimated) required for completion of existing project	2,738,793.55
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance available July 1, 1903	1,568,155.00
(See Appendix D D D 3.)	

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS AND CARE AND MAINTENANCE OF THE WASHINGTON MONUMENT IN THE DISTRICT OF COLUMBIA.

Officers in charge, Col. Theo. A. Bingham, U. S. Army, to April 30, 1903, and Col. T. W. Symons, U. S. Army, since that date.

The Executive Mansion has been remodeled, redecorated, and refurnished, an addition to it built; the conservatory and greenhouses formerly attached to the Mansion torn down, and five of the greenhouses reerected at the propagating gardens. A separate building for the offices of the President has been erected in the Executive Mansion grounds west of the Mansion. Extensive improvements have been made in the grounds at the north front of the Mansion.

At the Washington Monument the usual care required has been extended, much miscellaneous painting done and necessary carpentry, plumbing, and painting, repairs made at the lodge house

Inspections have been made from time to time of the various buildings occupied as offices by the War Department (except the State, War, and Navy Departments building) in connection with their care, repair, and safety.

The care required to maintain them in good condition has been extended to the improved parks and park places. Three of the small unimproved reservations, containing 0.021 acre, have been brought to the first stage of improvement. The work of improving the grounds of Mount Vernon square around the New Public Library building was commenced and partially completed. The 50-foot gravel roadway in the President's park outside of the iron fence inclosing the south grounds of the Executive Mansion was covered with broken trap rock and trap-rock screenings, the area surfaced amounting to 7,960 square yards. The part of Potomac Park adjacent to the Washington Monument grounds has been extensively improved by grading, constructing a macadam roadway, bridle path and walk, some new revetment wall, and increasing height of old revetment wall, constructing lawn surfaces, etc., and repairing old canal lock house at the Seventeenth and B streets entrance to the park for use as a lodge house. Iron post-and-chain fences have been erected around eleven reservations and the work of inclosing nine others completed by running chain through the posts erected in the preceding year. Part of the iron fence around the Executive Mansion, three of the watchmen's lodges, the iron post-and-chain fences inclosing three of the larger parks and sixty-nine of the small reservations and the iron posts and bars inclosing four others were painted. Two thousand and sixty-three feet of water pipe, 1,489 feet of iron drainpipe, and 4,169 feet of terra-cotta drainpipe were laid and 69 brick draintraps constructed. Seven hundred and twenty-three feet of granite curb was set. Two new and additional ornamental iron fountains were erected, and one old brick-and-cement fountain basin was replaced with a new ornamental iron fountain. The asphalt pavements in the parks have been extended by the construction of 1,807 square yards of footwalk and 780 square yards of asphalt roadway and 3,536 square yards of asphalt footwalk have been repaired and resurfaced.

At the propagating gardens necessary repairs were made to the greenhouse buildings and the superstructure of one of them rebuilt. The nursery stock was removed from the front to the rear of the grounds, and the front part of the grounds extensively improved. Six electric lights were erected in the gardens, and machinery and electric motors for operating it installed in the shop building. Over 1,000,000 plants were propagated.

The grounds around the statue of Rochambeau, in Lafayette Park, were restored. A roadway 30 feet wide and a walk 10 feet wide were constructed around the site of the Sherman statue, two courses of extra granite steps constructed around the base of the pedestal of that statue, and a contract entered into for constructing a marble mosaic floor on the space between the new steps and the lowest step of the pedestal. Work has progressed on the bronze figures for the statue.

Attention has been given to the telegraph line connecting the Capitol with the Departments and the Government Printing Office. The desirability of replacing the present overhead system of wires with underground conduits and cables has been submitted for the action of Congress, the report being printed in House Document No. 135, Fifty-sixth Congress, second session.

The damage done by a storm in February, 1897, and by high tide and wind in October, 1898, to the iron-pile wharf at Bridge Creek Landing, Virginia, near Wakefield, the birthplace of Washington, has not yet been repaired, there being no funds available for the work.

Attention is invited to the detailed report of the officer in charge and to his estimates and recommendations for the fiscal year ending June 30, 1905.

The estimates are as follows:

For the improvement and care of public buildings and grounds in charge of the Chief of Engineers	\$496,650
For compensation of persons employed on public buildings and grounds ..	82,620
For repair of existing telegraph lines connecting Capitol and Departments ..	1,500
For contingent and incidental expenses of public buildings and grounds ..	700
For care of Washington Monument and maintenance of elevator:	
Salaries of employees	\$8,520
Fuel, lights, contingencies, etc	3,000
Constructing a reception room	2,500
Paving roadways with asphalt	7,500
	21,520
	602,990

(See Appendix E E E.)

NORTHERN AND NORTHWESTERN LAKES—CORRECTING AND ISSUING CHARTS—SURVEYS—WATER LEVELS.

As early as 1816 local surveys of the Great Lakes for special purposes were made by engineer officers, but the "lake survey" as a systematic work was commenced in 1841. It was diligently prosecuted thereafter until 1882, when for a time extended field operations were suspended. The correction, printing, sale, and issue of charts continued without cessation, however, the additions and corrections being largely based upon local surveys and reports by engineer officers in charge of river and harbor improvements on the lakes.

Systematic field work was resumed in 1889, and has since been prosecuted with increased vigor. In 1896 operations were extended to include cognate work of observing and investigating the levels of the Great Lakes and their connecting waters, with a view to their regulation in the interest of commerce. The survey proper has from the beginning been carried on under the War Department, being at first conducted by the Chief of Topographical Engineers, and by the Chief of Engineers after the consolidation of the Topographical Engineers with the Corps of Engineers.

The first regular appropriation for the survey was made in 1841, and annual appropriations followed, with the single exception of 1847. The appropriations to date for all purposes of the survey during the sixty-two years of its existence have aggregated \$3,511,879, of which \$2,411.81 has reverted to the Treasury.

The following extract from Professional Papers of the Corps of Engineers, United States Army, No. 24, describes the conditions governing the navigation of the Great Lakes in 1841:

1. The lake survey was begun in 1841 under an appropriation of \$15,000 made in May of that year. At this time the country bordering on the lower lakes was already pretty well settled, and works for the improvement or formation of harbors had been commenced at most of the important points on Lakes Erie and Ontario. The upper lake region was but thinly settled, and there were no good harbors on Lake Huron and but one (the harbor of Chicago) on Lake Michigan. Settlers were, however,

pouring in rapidly, and there was even then a large and constantly increasing commerce between the lake ports, especially from Buffalo to Detroit and Chicago. Communication with Lake Superior could only be had by portage around the Sault Ste. Marie, but the great mineral wealth of the Lake Superior country was attracting attention, and a survey for a ship canal had been made in 1840 by officers of the Topographical Engineers. The lake commerce was carried on under many difficulties, which caused much loss of life and property each year.

There were no charts of the lakes except the Admiralty charts compiled from the surveys of Capt. H. W. Bayfield of the royal navy (English), and these were not in general use by the masters of American vessels. These charts were the results of rapid reconnaissances, and although they showed the coast lines with an accuracy which is remarkable, considering the rough methods of surveying employed, they were of little value as hydrographical charts of the American coast, because they showed the depths of water in comparatively few places, and but a small number of the many reefs and shoals which are found along the lake shores.

There were few lighthouses and beacons to indicate the positions of dangers to navigation, and, in the absence of charts, pilots were obliged to rely upon their own knowledge, which was frequently only acquired by the vessels grounding on a shoal or striking a hidden rock.

The navigation of the lakes is attended with peculiar dangers, because, while violent gales are frequent and the storms rival those of the ocean itself, a vessel is never more than a few hours run from the shore, and can not, as is generally the case at sea, drift before the wind until the storm is over, but in a long-continued gale must be thrown upon the shore unless a port or harbor of refuge can be entered. In 1841 a vessel leaving Chicago found no harbor or shelter in storms until the Manitou or Beaver Islands were reached, and after passing the Straits of Mackinac it was again exposed without refuge on Lake Huron, except in the vicinity of Presque Isle, until the head of St. Clair River was reached. In sailing from Chicago to Buffalo the greatest difficulties were encountered in the vicinity of the Straits of Mackinac and in the west end of Lake Erie on account of the many islands, shoals, and reefs found in those localities, and at the mouth of the St. Clair River, at which no improvements had been made in 1841 and where the channels were not only circuitous and narrow, but so shoal that vessels in low-water seasons frequently were compelled to have their cargoes taken over the bars in lighters.

It was therefore with the double object of furnishing reliable charts to lake vessels and of determining from the surveys the works of improvement which were necessary to the prosperity of the lake commerce that Congress in 1841 directed a survey of the lakes, and that annual appropriations, with the single exception of the year 1847, have since been made for carrying on the survey. Some idea of the magnitude of the work may be had from the following dimensions:

"The American shore line of the Great Lakes and their connecting rivers, if measured in steps of 25 miles, is about 3,000 miles, but if the indentations of the shore and the outlines of the islands be included the developed shore line is about 4,700 miles in length.

"Along rivers and where a lake is narrow it is necessary for navigation that both shores be mapped. This increases the length of the shore line to be surveyed between St. Regis, N. Y., and Duluth, Minn., to about 6,000 miles."^a

During the first ten years of the survey, while a general geodetic survey of the entire chain of lakes was contemplated for the future, the actual operations were mainly confined to surveys of special localities where improvements were called for or where the navigation was difficult; and where the surveys were more extended they were little more than reconnaissances. This course was made necessary because the appropriations were inadequate to the purchase of the finer instruments and the support of the larger force necessary for more extensive and more exact surveys, and also because of the pressing need of improvements at particular localities, for which preliminary surveys were essential.

The execution of the survey involved a great quantity of astronomic, topographic, and hydrographic work, all of which was performed with a high degree of skill and accuracy. The result was the completion of a series of reliable charts for lake vessels and the furnishing of a basis for works of channel improvement upon the lakes themselves and their connecting waters.

^a From memoranda respecting the lake survey, by Gen. C. B. Comstock, published in the Report of the Chief of Engineers for 1875.

The original series consisted of 76 charts, all of which were printed from copperplates. As a result of revisions, additions, and cancellations, there are now in force 94 lake-survey charts, of which 45 are printed in black from copperplates, 24 are lithographs in colors from copperplate transfers, 20 are lithographs in colors, and 5 are photolithographs in colors.

The charts issued in colors have all depths of 18 feet and less in blue, showing at a glance where vessels may proceed with safety, and are considered by vessel men much preferable to the old style printed in plain black and white. This new series of colored charts is believed to constitute a distinct advance in chart construction and printing, and meets with high favor from navigators and others.

From 1882 to June 30, 1903, a total sum of \$19,718.28 was derived from the sale of charts by the Detroit office and deposited in the United States Treasury.

Up to February 20, 1890, one full set of charts was issued free to each United States registered vessel. Any additional charts furnished such vessels and all furnished for other unofficial use were sold at the uniform price of 30 cents each. On the date above mentioned the free issue, except for official purposes of the Government, was discontinued, pursuant to law, and since then the charts have been sold for all private and unofficial use at prices ranging from 5 cents to 30 cents each, the price being intended in each instance to cover only the cost of paper and printing.

During the year the main work of the survey was conducted by Maj. Walter L. Fisk, Corps of Engineers, in charge of the principal office of the survey at Detroit, Mich. Nearly the whole work of conducting surveys and water-level observations, reducing the results thereof, and of correcting and issuing charts, was devolved upon that office. The district engineer officers rendered important aid by making local surveys and by regularly supplying valuable information for correcting the charts, bulletins, and supplements to the latter. These district officers are located at Duluth, Minn., Milwaukee, Wis., Chicago, Ill., Grand Rapids, Mich., Detroit, Mich., Cleveland, Ohio, and Buffalo, N. Y., with suboffices at Sault Ste. Marie, Mich., and Oswego, N. Y.

Charts may be purchased at the main office at Detroit, at the canal office at Sault Ste. Marie, Mich., and at the United States engineer office in Buffalo, N. Y. Complete sample sets may be seen at the United States engineer offices at Duluth, Minn., Milwaukee, Wis., Chicago, Ill., Cleveland, Ohio, and Oswego, N. Y., enabling purchasers to select exactly the charts they wish to order. It is hoped eventually to be able to furnish all the United States engineer offices mentioned with supplies of the charts for sale.

During the fiscal year ending June 30, 1903, the number of charts sold by the Detroit office was 11,573, and by the Buffalo office 1,866, the aggregate sales, 13,439, exceeding those of last year by over 25 per cent, and those of the preceding year by 96 per cent; the proceeds of the sales amounted to \$2,293.15 and were deposited to the credit of the Treasurer of the United States. The Detroit office issued 2,868 charts for official use and the Buffalo office 142, a total of 3,010. To date more than 270,000 of these charts have been sold and issued for actual service.

During the year important corrections and additions were made in

the Detroit office to three of the old charts for use in the Office of the Chief of Engineers in bringing the electrotype plates up to date, from which, and other corrected plates, new editions of many of the charts have been printed in Washington.

Besides the above, the Detroit office has, during the year, revised 13 other copperplates, transferred 11 copperplate charts to stone, and published editions in colors therefrom, reproduced 5 manuscript charts on copper by heliogravure, engraved on stone and issued in colors 9 entirely new charts of the regular series, and 7 insets for Bulletins Nos. 12 and 13 and supplements.

Of the entire series of charts there were issued in colors, 5 on July 1, 1900, 12 on July 1, 1901, 30 on July 1, 1902, and 49 on July 1, 1903.

There are now seven parties in the field, as follows:

One engaged on resurvey of Green Bay and the passages leading into it from Lake Michigan; one on resurvey of northern Lake Michigan and the straits of Mackinac; one connecting the United States lake survey system of triangulation in the vicinity of the mouth of St. Marys River with the Canadian triangulation along the north and northeast coasts of Lake Huron; one doing the triangulation to control the hydrography in northern Lake Michigan; one on resurvey of the entire west end of Lake Erie; one making local surveys for new harbor charts and correction of those already issued; and one taking the slope of Niagara River from Lake Erie to Niagara Falls.

From July 1, 1902, to the close of the last field season, the discharge measurements of Lake Superior at the international bridge, of St. Clair River, and of Detroit River were continued, completing the desired data for the stages of water occurring during that time.

The precise level line from "Greenbush" bench mark at Albany to Lake Survey bench mark "A" at Oswego was completed and the results, worked up during the winter, will be found in Appendix F F F 1 to this report. This information was promptly furnished to the United States Coast and Geodetic Survey for use in its discussion of the general network of the country. As all the lakes have already been connected by precise levels, this Greenbush-Oswego line, with the new determination of the elevation above mean tide at New York of Greenbush bench mark made by the Coast and Geodetic Survey, will definitely fix the elevations of the Great Lakes above tide water.

Several local surveys and examinations were made to provide data for projecting new charts and correcting old ones.

The extensive revision of the charts now under way has for its object to show to date the changes which have taken place, due to natural and artificial agencies, in order to better serve the deeper draft vessels now engaged in lake commerce. Many of the original charts were prepared with reference to a navigation calling for a draft not exceeding 12 feet. The soundings were referred to planes representing mean or average stages of water, and general depths exceeding 18 feet below such planes were not closely developed. Present conditions of commerce demand, however, that the bottom be accurately charted to depths of not less than 30 feet in the open lakes, or 25 feet in their connecting rivers or straits, and these depths should relate to "low-water" stages instead of to the "mean stages" referred to above. This will call for extensive surveys and a vast amount of office work, all of which must be done with great care and accuracy. To secure a satisfactory rate

of progress will require an expenditure of at least \$140,000 during the year ending June 30, 1905.

In addition to work relating to charts, the Detroit office continued operations during the year under the project adopted in 1898 for an exhaustive investigation of lake levels, as described in the Annual Report of the Chief of Engineers for that year, pages 3774-3776. The principal field work comprised an accurate series of discharge measurements in the Detroit, St. Clair, and St. Marys Rivers, together with local surveys related to these measurements; also the maintenance of 14 self-registering water gauges on the several lakes from Ontario to Superior and Michigan, which supply an accurate and continuous record of the most minute changes in the elevation of the water surface. The observations have been very satisfactory and are exceedingly valuable, fixing closely the discharges of all the Great Lakes for the stages prevailing at the time, but they should be continued until the lake elevations have varied through a much greater range than has heretofore occurred since they were undertaken. In Appendix F F 1 of this report will be found a table giving the discharges of all the Great Lakes at the mean stage of each for the past forty-two years as determined from the monthly means shown on the plate in the same appendix. This work is now fully organized, and it is highly important that it be pushed to completion as rapidly as possible. For this purpose the sum of \$10,000 should be made available for expenditure during the fiscal year ending June 30, 1905.

It is therefore recommended that the appropriation for that year be made to include the two amounts indicated above, and that it be formulated as in the act of March 3, 1903, as follows:

Estimate for the fiscal year ending June 30, 1905.

For survey of the Northern and Northwestern Lakes, including all necessary expenses for preparing, correcting, extending, printing, and issuing charts and bulletins, and of investigating lake levels with a view to their regulation, to be immediately available and to remain available until expended\$150,000.00

Surveys, additions to, and correcting engraved plates.

July 1, 1902, balance unexpended\$182,309.39
June 30, 1903, amount expended during fiscal year 151,717.82

June 30, 1903, balance unexpended 30,591.57
Amount appropriated by sundry civil act of March 3, 1903 (including printing and issuing charts) 150,000.00

July 1, 1903, balance unexpended 180,591.57
Claim settled by auditor (printing charts) ^a 31.62

Bulletins.—The preparation and issue of the series of bulletins, commenced in 1889, relating to the river and harbor improvements and navigation of the Great Lakes, hitherto done by this Office, was transferred to the Detroit office, and of Bulletin No. 13, the first issued there, over 1,400 copies have already been distributed to the marine interests and requests for it are constantly being received, some even coming from points in Wyoming and California.

The numbers published during the year were as follows:

- Bulletin 12 A, July 9, 1902.
- Supplement No. 1 to Bulletin 12, September 23, 1902.
- Supplement No. 2 to Bulletin 12, October 16, 1902.

^a Appropriation for survey of Northern and Northwestern Lakes, 1901.

Supplement No. 3 to Bulletin 12, October 27, 1902.
 Supplement No. 4 to Bulletin 12, November 11, 1902.
 Supplement No. 5 to Bulletin 12, December 31, 1902.
 Bulletin 13 (A, B, C, D, E, in one volume), April 15, 1903.
 Supplement No. 1 to Bulletin 13, May 20, 1903.
 Supplement No. 2 to Bulletin 13, June 15, 1903.

These bulletins and supplements give the latest and fullest descriptions of the progress in works of river and harbor improvements intended to benefit the navigation of the Great Lakes and their connecting waters, and of the results of surveys in those waters made under the direction of the Detroit office of the lake survey and the district engineer officers. Small maps showing locations of new shoals, changes in important channels, new harbors, and those not otherwise charted, etc., are inserted in both bulletins and supplements from time to time.

Annual water levels of the Northern and Northwestern Lakes.—A table showing the monthly water levels from July 1, 1902, to June 30, 1903, at Marquette, Mich., on Lake Superior; Milwaukee, Wis., on Lake Michigan; Sand Beach, Mich., on Lake Huron; Cleveland, Ohio, on Lake Erie, and Charlotte, N. Y., on Lake Ontario, will be found in Appendix F F F 1.

(See Appendix F F F 1.)

Charts.—Under the supervision of this Office during the fiscal year additions have been made to the engraved plates of—

Chart of St. Clair River.

Chart of L'Anse, including Portage Entry and part of Keweenaw Bay, Lake Superior.

Outflow, rainfall, and evaporation in the valley of the Northern and Northwestern Lakes.—A special report on the outflow, rainfall, and evaporation in the valley of the Great Lakes has been in preparation since 1899 in the United States Engineer Office, Detroit, Mich., now in the charge of Maj. William H. Bixby, Corps of Engineers, and will be found in Appendix F F F 2.

Alleged shoal or reef south of Manitowoc, Wis.—A survey was made, and a report with tracing showing the location and soundings thereon was submitted under date of April 13, 1903, relative to the alleged shoal or reef said to be situated 4 miles south of Manitowoc Harbor and 2½ miles offshore, upon which the master of the steamer *Tuscarora* reported striking. This work was in the charge of Maj. James G. Warren, Corps of Engineers, and his report thereon will be found in Appendix F F F 3.

Reef off Wind Point, near Racine Harbor, Wisconsin.—The reef upon which the steamer *Saranac* was reported to have struck April 14, 1903, was located and plainly marked under the direction of Maj. James G. Warren, Corps of Engineers, and his report thereon will be found in Appendix F F F 3. Owing to the want of facilities in the Milwaukee engineering district for making the required thorough survey of the reef and its vicinity, the work was immediately undertaken by Maj. Walter L. Fisk, Corps of Engineers, in charge of the survey of the Northern and Northwestern Lakes, Detroit, Mich., and is still in progress.

July 1, 1902, balance unexpended	\$309. 86
June 30, 1903, amount expended during fiscal year	234. 04

June 30, 1903, balance deposited to the credit of Treasurer, United States.	75. 82
---	--------

IMPROVEMENT OF THE YELLOWSTONE NATIONAL PARK, INCLUDING THE CONSTRUCTION, REPAIR, AND MAINTENANCE OF ROADS AND BRIDGES.

Officer in charge, Capt. Hiram M. Chittenden, Corps of Engineers. The work has been in the charge of the Engineer Department since 1883, except during the period from August, 1894, to March, 1899.

The present project, adopted August 27, 1900, modified by authority of the Secretary of War dated July 22, 1901, and further modified by authority of the Chief of Engineers dated May 29, 1902, embraces the following work:

(a) Belt line or main circuit, which includes all the important centers of interest in the park, viz, Mammoth Hot Springs, Norris Geyser Basin, the Firehole Geyser basins, the Yellowstone Lake, the canyon and falls of the Yellowstone, and the section near Tower Falls.

(b) Four approaches leading from the boundary of the park to different points on the belt line.

(c) Side roads to isolated objects of interest, as well as bridle trails for use by exploring parties and by troops and scouts in patrolling the park.

(d) The macadamization or thorough surfacing with best material available of the belt line.

(e) The provision of a sprinkling plant to keep down the dust on the main system.

(f) Extensive improvements at Mammoth Hot Springs, to be carried out in cooperation with the Quartermaster's Department.

The estimated total mileage of the completed system is about 306 miles in the park proper and 417 miles including the roads in the forest reserve.

On the project for the general road system there has been expended to June 30, 1903, the sum of \$1,106,232, including annual maintenance and repairs. It is estimated that not less than \$200,000 of this amount was expended in early work, which has since been replaced by other work, and does not therefore form a part of the completed system. Annual maintenance and repairs have cost over \$225,000, leaving about \$650,000 that has gone into permanent new work. The result of this expenditure (and of about \$20,000 for a military road in the Teton Forest Reserve, now a part of the park road system) has been about 400 miles of road now open to travel, although not all completed. The number of bridges of all sizes built is about 125.

The work done under the last appropriation, including annual maintenance and repairs, was as follows:

Extensive work at Mammoth Hot Springs, including reconstruction of the roads, the building of a large amount of concrete sidewalk, the grading and irrigation of the grounds, the completion of the water-supply system, the installation of an electric-light plant, and the erection of several necessary buildings.

The reconstruction of the road between Gardiner and Mammoth Hot Springs, including the partial construction of an entrance gate at the north boundary.

The partial construction of a road between Mammoth Hot Springs and the Middle Gardiner.

The reconstruction and surfacing of 7 miles of road between Mammoth Hot Springs and Norris.

The reconstruction of the road in the vicinity of Virginia Cascade and at Blanding Hill.

The reconstruction of three stretches of road in the Gibbon Canyon for the purpose of cutting out bad hills.

The completion of about 3 miles of road on the Natural Bridge Cut-off.

The grading of a new crossing of Cascade Creek at the Grand Canyon, and the surfacing with rock of about one-half mile of road in that vicinity.

The construction of about 10 miles of new road on the Mount Washburn division.

The opening of nearly 40 miles of new road on the eastern approach.

The opening of 4 miles of road, southern approach, and the completion of about 6 miles more.

The purchase and partial erection of nine new bridges, including the Melan Arch Bridge over the Yellowstone.

The purchase of twelve new sprinkling wagons and the installation of the plant between Gardiner and Norris.

Extensive repairs to the entire system. Owing to the lateness of the season and the excessive amount of freight hauling in the early spring, the roads suffered very heavily, and the cost of opening them up was much greater than usual.

A new station house and barn were built for the superintendent at the south boundary.

By the terms of the sundry civil act of June 28, 1902, Congress adopted the approved project for the work and made provision for its completion, including also annual maintenance and repairs, at the rate of \$250,000 per year for three years.

For full details as to operations of the past fiscal year, see the report of the officer in charge.

July 1, 1902, balance unexpended.....	\$256,390.51
Amount appropriated by sundry civil act approved March 3, 1903.....	250,000.00
Amount received from United States Commission of Fish and Fisheries for sawing lumber.....	210.00
July 1, 1903, balance unexpended.....	506,600.51
June 30, 1903, amount expended during fiscal year.....	347,645.77
July 1, 1903, balance unexpended.....	158,954.74
July 1, 1903, outstanding liabilities.....	91,211.71
July 1, 1903, balance available.....	67,743.03
Amount (estimated) required for completion of existing project.....	250,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for works of improvement and for maintenance of improvements, in addition to the balance unexpended July 1, 1903.....	250,000.00
(See Appendix G G G.)	

RECONNAISSANCES, EXPLORATIONS, AND WORK IN THE FIELD.

Engineer officers and acting engineer officers on the staffs of commanding generals of military divisions and departments have been engaged during the year in building and repairing wagon roads and bridges, making surveys in the field, making and distributing maps, and in other duties incidental to the work of engineers in the field.

Reports of such work have been submitted by the following officers:
Col. Oswald H. Ernst, Corps of Engineers, at the Department of the Lakes.

Col. David P. Heap, Corps of Engineers, at the Department of California.

Lieut. Col. William R. Livermore, Corps of Engineers, at the Department of the East.

Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, at the Division of the Philippines.

Maj. Smith S. Leach, Corps of Engineers, at the Department of the Missouri.

Maj. William C. Langfitt, Corps of Engineers, at the Department of the Columbia.

First Lieut. Hugh A. Drum, Twenty-seventh Infantry, at the Department of the Colorado.

Col. Oswald H. Ernst, Corps of Engineers, engineer officer, Department of the Lakes, reports that the field work consisted of the commencement and completion of a survey of the proposed addition to the reservation of Fort Sheridan, Ill., and of the reservation of Columbus Barracks, Ohio. The maps of the first-named survey were constructed and those of the latter were in progress. The usual routine office work was performed; maps were furnished for the information of the officers at the headquarters and in the department, and drawing material and surveying instruments were issued to the engineer officers at posts in the department upon requisition.

(See Appendix H H H 1.)

Col. David P. Heap, Corps of Engineers, engineer officer, Department of California, reports that a road was built from the town of Sausalito to Fort Baker, and one partly built at Alcatraz Island, both by prison labor; that a report and map showing the work accomplished on the military reservation at Monterey, Cal., relative to the condition of the boundary fences, lines run, etc., was submitted to the adjutant-general of the department; that levels were run and curves laid off for gutter to be built on the reservation of the Presidio of San Francisco; that a scheme for steel safety shields for a 300-yard range at the Presidio, which was evolved by Maj. Gen. R. P. Hughes, was elaborated and surveys and drawings made; that lines were run, location of all the buildings laid off, lines for sewers run, and surveys incidental to building the new post at Monterey were made, and a survey of the adjoining land, which the city of Monterey proposed to donate to the United States for military purposes was also made; that a survey of a proposed new road on the reservation of the Presidio of San Francisco was made and profiles and sections submitted. A line of a proposed, and much-needed road at Fort Baker, Cal., was indicated on an existing map; a report, illustrated by photographs of the country traversed, and maps and estimates of cost were submitted; this road is now under construction. A range for small-arms practice at Benicia, Cal., was laid off; an estimate of cost and report relative to a concrete retaining wall at Fort Mason was submitted, and surveying instruments and appliances were distributed to regimental lyceums and schools.

(See Appendix H H H 2.)

Lieut. Col. William R. Livermore, Corps of Engineers, engineer officer, Department of the East, reports that under General Orders,

No. 1, Headquarters Department of the East, January 12, 1903, and in compliance with paragraph 20, Special Orders, No. 286, Headquarters of the Army, series 1902, he was announced as engineer officer of the Department; that Capt. William V. Judson, Corps of Engineers, was the engineer officer prior to that time. The principal work of the engineer office consisted in the preparation of numerous maps, etc., for the use of the commanding general, Department of the East, and furnishing information pertaining to engineer matters to officers of the department. During the year usual routine work was performed and certain surveys of Government lands were made in Porto Rico.

June 30, 1903, amount withdrawn from United States Treasury during the fiscal year, 1903, from allotments aggregating \$4,800 made by the Chief of Engineers to the engineer officer, Department of the East	\$3,900.00
June 30, 1903, amount expended during fiscal year	3,890.26
June 30, 1903, unexpended balance (will be deposited to credit of United States during July, 1903)	9.74
	3,900.00

(See Appendix H H H 3.)

Lieut. Col. Charles E. L. B. Davis, Corps of Engineers, chief engineer officer, Division of the Philippines, reports: Officers on duty as assistants to the chief engineer officer of the division—Maj. Clinton B. Sears, Corps of Engineers, to May 7, 1903; Maj. Curtis McD. Townsend, Corps of Engineers, May 28 to June 30, 1903; Capt. Henry Jervey, Corps of Engineers; Lieut. Lytle Brown, to September 17, 1902; Lieut. Arthur Williams, to September 22, 1902.

Engineer officer, Department of Luzon: Capt. William W. Harts, Corps of Engineers, to June 4, 1903; Capt. Spencer Cosby, June 4 to June 30, 1903.

Engineer officer, Department of Mindanao: Capt. Jay J. Morrow, Corps of Engineers.

Engineer officer, Department of the Visayas: Lieut. E. I. Brown, Corps of Engineers.

ENGINEER TROOPS.

The entire Second Battalion of Engineers was on duty in the division until June 6, 1903, when Companies G and H were relieved per General Orders, No. 34, Headquarters Division of the Philippines, May 5, 1903, and left for San Francisco on the U. S. Army transport *Thomas*, under command of Capt. William W. Harts, Corps of Engineers.

Companies I and K, Third Battalion of Engineers, under command of Maj. Curtis McD. Townsend, Corps of Engineers, arrived at Manila May 27, 1903, as per General Orders, No. 10, Headquarters of the Army, Adjutant-General's Office, January 29, 1903.

The duties of the troops have consisted in road and bridge building, exploration and location of trails, reconnaissance, road sketching, map making, hydrographic, topographic, and land surveying, photography, wharf building, superintendence of building of posts, barracks, and quarters, and other minor engineering work, for which purposes the officers of the battalion have been detached and the enlisted men scattered in detachments throughout the archipelago.

OFFICE WORK.

The office work has been the usual routine incident to the administration of the departments—of mapping, blue printing, and photography, the construction and repair of roads and bridges, and the improvement of the port of Manila and the Pasig River.

MAP WORK.

The compilation of maps and reconnaissance sketches has been continued throughout the year, and 21 new maps have been prepared. Over 4,000 blue prints have been distributed to officers serving in the Philippines. A marked decrease in the number of maps asked for has followed the cessation of active field operations.

ROADS AND BRIDGES.

This work has been carried on under an appropriation from insular funds, act No. 1, United States Philippine Commission, \$2,000,000 Mexican, and has been in continuation, betterment, and extension of the work of the previous year. The appropriation is nearly exhausted, and the work will be discontinued at an early day, leaving the future care of the roads and bridges to the provincial authorities, to whom the plant purchased from insular funds has been or will be transferred.

MANILA HARBOR AND THE PASIG RIVER.

The improvement of Manila Harbor and the Pasig River is being carried out with insular funds, consisting of a continuous appropriation not to exceed \$4,029,000 United States currency, of which \$2,000,000 has been actually appropriated.

The approved project is the building of a timber and stone bulkhead from the canal entrance near the mouth of the Pasig River, parallel to the Malecon drive and about 2,000 feet therefrom, to the intersection of the east jetty, which is to be prolonged with riprap foundation and masonry superstructure; the dredging out of the harbor basin behind the breakwater to a depth of 30 feet, and the filling in of the dredged material behind the bulkhead to a level of 10 feet above low water; the completion and extension of the present breakwater; the construction of a detached breakwater 3,000 feet long; the deepening of the canal; the dredging of the bar at the mouth of the Pasig, and of the latter as far as the Bridge of Spain, to a depth of 18 feet (mean low water), and the dredging of the upper Pasig to give a 6-foot low-water navigation.

The harbor work is being done by contract with the Atlantic, Gulf and Pacific Company to the amount of \$2,150,000, to be completed in three years from May 1, 1902, and the Pasig River work is being done by day labor and the use of the plant owned and being built by the insular government.

In the harbor work the contractors have built 4,189 feet of bulkhead and protected it by 102,954 tons of riprap; 93,832 tons of rock have been placed in the breakwater; 1,550,233 cubic yards of material have been dredged from the outer harbor and deposited behind the bulkhead.

During the past year 696,264 cubic yards of material was dredged

from the lower Pasig River and the bar at its mouth. A dredge and three dump scows have been constructed for the upper Pasig.

The following statement showing the net tonnage and number of vessels that entered and cleared at the port of Manila during the calendar years 1900, 1901, and 1902 has been furnished by the collector of customs for the Philippine Archipelago:

Coastwise.

Year.	Entered.	Tonnage.	Cleared.	Tonnage.
1900	1,788	335,259	1,830	334,606
1901	1,831	253,910	1,956	399,303
1902	1,627	315,969	1,634	329,451

Foreign.

Year.	Entered.	Tonnage.	Cleared.	Tonnage.
1900	462	673,148	394	646,412
1901	561	896,444	489	827,420
1902	621	1,029,022	576	1,007,242

EXPENDITURES.

[Funds allotted by the Chief of Engineers U. S. Army.]

	U. S. currency.
Civilian assistants to engineer officers, 1903	\$5,871. 19
Engineer equipment of troops, 1903	344. 83
Sites for fortifications and seacoast defenses	977. 72
Total	7,193. 74

INSULAR FUNDS.

	Mexican currency.
Repairs to roads and bridges, Philippine Islands	\$57,665. 37
Calamba-Batangas road	26,000. 00
Total	83,665. 37
Improvement of the port of Manila (United States currency)	802,242. 13
(See Appendix H H H 4.)	

Maj. Smith S. Leach, Corps of Engineers, engineer officer, Department of the Missouri, reports that maps of posts and reservations called for in General Orders, No. 14, Department of the Missouri, 1902, were received from Jefferson Barracks, Mo., and Forts Reno and Sill, Okla.; the maps of the other posts were in preparation. The magnitude of the work involved at Leavenworth and Riley, the disappearance of the initial point of the old survey at Fort Robinson, and the frequent changes of engineer officers at the several posts operated to delay the completion of the maps. A topographical assistant will be sent to Fort Robinson about September 1 to attempt to recover the position of the old flagstaff upon which the boundary of the reservation depends. A map of the Fort Riley Reservation and surrounding country and another on a larger scale of the reservation only were prepared and a large number of blue prints made for distribution to officers of the various organizations, regular and militia, participating in the field maneuvers

at Fort Riley. Tracing was made and an edition of 500 copies lithographed for binding with the report of the chief umpire, this last under an especial allotment of funds from the Chief of Engineers. The compilation of a map of the department has been in progress since January, 1903. It will be $4\frac{1}{2}$ by 6 feet, in four sheets. The projection has been completed, the principal cities and towns plotted from geographical coordinates, and the transfer sheets for about one-half the entire area have been drawn. There is no map of the department with its present limits, and the latest of any considerable part of it is a map of the old department of the Platte of 1889. The routine work consisted of making tracings and blue prints of various posts, issue and receipt of engineer property, and correspondence. Until December, 1902, the office force consisted of a draftsman, who gave part of his time to the ordnance and signal offices and the rest to the Engineer Office. Since December, 1902, a topographical assistant has given his entire time to the engineer work. This report was submitted to the adjutant-general of the Department of the Missouri.

(See Appendix H H H 5.)

Maj. William C. Langfitt, Corps of Engineers, engineer officer, Department of the Columbia, reports that the duties, records, etc., pertaining to the engineer office were transferred to him by Maj. William R. Abercrombie September 30, 1902, in compliance with Special Orders, No. 219, Adjutant-General's Office, 1902, and General Orders, No. 25, Department of the Columbia, 1902; that the only funds disbursed were for services for civilian assistants; useless material was eliminated from the records and a new index made; maps of route of marches and of the barracks were made, and miscellaneous field work in connection with target range, roads, and gravel pit was performed: map of wharf made; measurements and drawings of old and new buildings for change of water and sewer pipes were made; survey and maps were made of part of reservation to be cleared of underbrush, and plan and profile map of proposed gymnasium sewerage and location of new gymnasium were furnished to the quartermaster; survey for change in location of officers' quarters was made for the adjutant-general; lines of sewer diversions from post hospital and company quarters laid out; surveys made of site and location established for new double-battery quarters and bachelor-officer quarters, and other buildings were staked out and elevations established. At the close of the year the field work and preparation of maps for use of troops in the departmental maneuvers was in progress. A large number of original maps, tracings, blueprints, photographs, etc., were made.

For civilian assistants to engineer officers, 1902.

Allotted July 9, 1902	\$1,500.00
Allotted October 21, 1902	500.00
	2,000.00
Amount expended during fiscal year	\$1,468.33
Balance unexpended and deposited to the credit of the Treasurer of the United States	531.67
	2,000.00

(See Appendix H H H 6.)

First Lieut. Hugh A. Drum, Twenty-seventh Infantry, acting engineer officer, Department of the Colorado, since June 19, 1903, reports

that First Lieut. Burton J. Mitchell, Twelfth Infantry, aid-de-camp, was in charge of the engineer office from July 1, 1902, to March 1, 1903; Maj. Charles A. Varnum, Seventh Cavalry, from March 2 to May 18, 1903, and First Lieut. Henry B. Farrar, Artillery Corps, from May 19 to June 19, 1903; that under the authority of the Chief of Engineers United States Army, two draftsmen were employed, one from November 13, 1902, to January 16, 1903, and the other from January 17 to June 30, 1903; by the same authority two clerks were employed, one from November 3, 1902, to May 31, 1903, the other from June 8 to June 30, 1903. The office work consisted of the completion of a new map of the department, making of numerous tracings and blue-prints of official maps, issuing of instruments to engineer officers of posts. A large number of maps in the office have been classified, and an index of same is in course of preparation. The offices assigned to the acting engineer officers of the department are not suitable for map making and solar printing, and additional room is needed for the care of instruments, etc.

(See Appendix H H H 7.)

ESTIMATE FOR AMOUNT REQUIRED FOR MAPS, INCLUSIVE OF WAR MAPS.

For publication of maps for use of the War Department, inclusive of war maps, \$5,000.

Paragraph 393 of the Army Regulations requires that the commanding officer of each post where there are fixed batteries bearing upon a channel will call upon the Engineer Department for accurate charts showing the soundings to the extent of the ranges of the guns. Calls upon this Department to perform its duty under this regulation are now being honored as rapidly as possible. To further the work \$5,000 should be appropriated for the fiscal year ending June 30, 1905.

NEW BUILDING FOR GOVERNMENT PRINTING OFFICE.

Officer in charge, Capt. John S. Sewell, Corps of Engineers; assistant, Lieut. Clarke S. Smith, Corps of Engineers.

This building was authorized by the sundry civil act approved March 3, 1899, and its limit of cost was increased from \$2,000,000 to \$2,429,000 by a joint resolution approved February 17, 1900. For the wording of these acts reference is made to Appendix H H H, Annual Report of the Chief of Engineers for 1901.

Since the date of the last report the building has been practically completed, although considerable quantities of work remain to be done on the following items: Marble work in the main entrance, mosaic floors in the main entrance, decoration in the main entrance, vault doors, elevator inclosures and cars, electric wiring, pneumatic tubes, bronze doors, and lamp standards. In addition to this work, there are some fireproof partitions wanted by the Public Printer, and the contractor for the wood-block floors is under the necessity of executing considerable repairs, due to the fact that he put some of the floors down too dry and they subsequently swelled and came up in spots.

It is expected that the building will be completed in all its details by September 1, 1903, except for the pneumatic tubes and such extra work as the Public Printer may want done, including the extra partitions already referred to.

The building has not been completed as promptly as was hoped for, largely owing to the great activity in all lines of the building trades,

and to strikes and other causes not foreseen when the first estimate of time required was made, but it will be entirely finished within the authorized limit of cost, and possibly there will be a small balance to turn back into the Treasury.

Contracts have been let for everything required for completing the building in all its details, except for the extra partitions and such other extra work properly chargeable to the construction of the building as the Public Printer may desire to have put in.

The present condition of the appropriation is as follows:

Amount appropriated by act of March 3, 1899	\$350,000.00
Amount appropriated by act of June 6, 1900	775,000.00
Amount appropriated by act of March 3, 1901	1,304,000.00
	2,429,000.00
June 30, 1903, amount expended to date	2,225,644.82
July 1, 1903, balance unexpended	203,355.18
July 1, 1903, outstanding liabilities	\$41,625.04
July 1, 1903, covered by existing contracts	117,330.60
	158,955.64
July 1, 1903, balance available	44,399.54

(See Appendix I I I.)

BUILDINGS, ARMY WAR COLLEGE, WASHINGTON, D. C., AND ENGINEER SCHOOL, WASHINGTON, D. C.

Officer in charge, Capt. John S. Sewell, Corps of Engineers; assistant, Lieut. Clarke S. Smith, Corps of Engineers.

BUILDINGS, ARMY WAR COLLEGE.

Work on the design of the War College building was taken up by the architects in July and August, 1902. The general design was practically completed before January 1, 1903. Meantime some investigations had been made as to the probable nature of the foundations.

Actual construction has developed the fact that part of the building is on solid ground and part over filled ground, through which the excavations had to be carried to a depth of about 18 feet to reach solid bottom.

On February 21, 1903, the northeast corner stone of the building was laid with Masonic ceremonies.

The foundations at the west end of the building, over about 40 per cent of its area, have been practically completed. A considerable quantity of granite base course has been put in position on top of the concrete foundations. A sewer for discharging the drainage of the War College building into the river has been completed from its outfall to the building line. Additional funds will be needed to complete the project according to the plans of the architects. An estimate of \$300,000 is submitted for this purpose.

The present condition of the appropriation is as follows:

Amount made available by act of June 30, 1902	\$400,000.00
June 30, 1903, amount expended to date	28,311.15
July 1, 1903, balance unexpended	371,688.85
July 1, 1903, outstanding liabilities	\$11,105.74
July 1, 1903, covered by existing contracts	43,563.80
	54,669.54
July 1, 1903, balance available	317,019.31

BUILDINGS, ENGINEER SCHOOL.

Preliminary work at the Engineer School began in August, 1902, when a number of tests of the ground were made to determine the kind of foundations that would be necessary. Work was laid out, sites of buildings cleared of trees, etc. Plans were not sufficiently advanced to commence actual foundation work until the latter part of October, 1902. The ground is very irregular. Some of the buildings can be supported on foundations of the ordinary type, while others have required a foundation of concrete piles.

The site of barrack No. 1, which was the only barrack site unincumbered, has, unfortunately, given more trouble than any other in the matter of foundations, but the present prospect is that this work will be speedily completed and that the construction of the barrack can be pushed rapidly ahead. A considerable portion of the foundations of this barrack building is already finished, and a fair start has been made on the brickwork at the east end.

Excavation is well advanced on the two mess-hall and kitchen buildings, and for that portion of barrack No. 2 which is not fouled by the general hospital buildings. The foundations for the band barrack are also well advanced.

The line of officers' quarters is well under way. Nine of them are up to the first-story level and six have the first-story joists in place. All of them except two, which are to be placed on the sites now occupied by the frame barracks of the Hospital Corps, are progressing with reasonable rapidity.

The funds appropriated are sufficient to complete the project according to original plans and estimates.

The present condition of the appropriation is as follows:

Amount appropriated by act of June 30, 1902.....	\$500,000.00
Amount appropriated by act of March 2, 1903.....	360,000.00
	860,000.00
June 30, 1903, amount expended to date.....	53,198.74
July 1, 1903, balance unexpended.....	806,801.26
July 1, 1903, outstanding liabilities.....	\$8,833.21
July 1, 1903, covered by existing contracts.....	87,107.27
	95,940.48
July 1, 1903, balance available.....	710,860.78

(See Appendix J J J.)

CONSTRUCTION OF MILITARY ROAD FROM FORT WASHAKIE TO MOUTH OF BUFFALO FORK OF SNAKE RIVER, WYOMING.

Officer in charge, Capt. Hiram M. Chittenden, Corps of Engineers.

The first appropriation for this work was made by act of June 4, 1897; construction was commenced in August, 1898, and finished in October of the same year, so far as funds would permit. For description of the locality, character and value of the road, and work done to June 30, 1899, see Annual Report of the Chief of Engineers, 1899, Part IV, pages 3881-3900.

Amount expended to June 30, 1902, \$18,385.10; amount expended during fiscal year ending June 30, 1903, \$1,614.90.

The sundry civil act of June 6, 1900, appropriated \$10,000 for repair and completion of the road. A project was submitted June 17, 1900, and approved June 22, 1900. Work began immediately after the 1st

of July and continued until the 13th of September. It consisted entirely in completing and repairing the road built in 1898. The most important item of the work was the construction of a large bridge, 117 feet long, over Buffalo Fork of Snake River. In the month of October a reconnaissance was made along the Wind River Valley to determine the best location for a road along that stream, if there should be an appropriation for completing the road.

The remaining balance of the appropriation was expended during the month of August, 1902, in general improvement work along the existing line, most of the work being done near the east end. The work presented no features meriting particular mention.

As there is not likely to be any further appropriation for this work it may be regarded as closed and this the final report upon it.

July 1, 1902, balance unexpended	\$1,614.90
June 30, 1903, amount expended during fiscal year	1,614.90

(See Appendix K K K.)

ERECTION OF MONUMENTS TO GENERALS FRANCIS NASH AND WILLIAM LEE DAVIDSON, OF NORTH CAROLINA.

This work was in the charge of Capt. E. Eveleth Winslow, Corps of Engineers.

Sites in the Guilford battle grounds, near Greensboro, N. C., have been selected by the governor of the State of North Carolina and approved by the Secretary of War.

Designs for the monuments are under consideration.

MONUMENT TO GENERAL NASH.

Amount appropriated by joint resolution of Congress approved January 30, 1903.....	\$5,000.00
June 30, 1903, amount expended during fiscal year	22.33
July 1, 1903, balance unexpended	4,977.67

MONUMENT TO GENERAL DAVIDSON.

Amount appropriated by joint resolution of Congress approved January 30, 1903.....	\$5,000.00
June 30, 1903, amount expended during fiscal year	22.33
July 1, 1903, balance unexpended	4,977.67

(See Appendix L L L.)

OFFICE OF THE CHIEF OF ENGINEERS.

During the fiscal year ending June 30, 1903, the following-named officers were on duty in this office as assistants:

Col. Alexander Mackenzie.

Lieut. Col. William R. Livermore, until July 10, 1902.

Maj. James L. Lusk, until March 18, 1903.

Maj. Frederic V. Abbot.

Maj. Harry F. Hodges, since August 5, 1902.

Capt. Mason M. Patrick.

Capt. William V. Judson, since June 13, 1903.

Capt. Charles S. Bromwell, until September 17, 1902.

Capt. Charles W. Kutz, since March 14, 1903.

Very respectfully, your obedient servant,

G. L. GILLESPIE,

Brig. Gen., Chief of Engineers,

U. S. Army.

Hon. ELIHU ROOT,

Secretary of War.

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

APPENDICES
TO THE
REPORT OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY.

FORTIFICATIONS, ETC.

APPENDIX No. I.

REPORT OF THE BOARD OF ENGINEERS.

THE BOARD OF ENGINEERS, ARMY BUILDING,
New York City, July 9, 1903.

GENERAL: I have the honor to submit the annual report recounting the operations of The Board of Engineers for the year ending June 30, 1903.

The following changes in the personnel of the Board have taken place since the date of the last annual report:

Lieut. Col. W. R. Livermore, Corps of Engineers, was detailed as a member by paragraph 22, Special Orders, No. 157, Headquarters of the Army, A. G. O., July 5, 1902.

Maj. Rogers Birnie, Ordnance Department, was detailed as a member by paragraph 6, Special Orders, No. 167, Headquarters of the Army, A. G. O., July 17, 1902.

Commander J. C. Fremont, U. S. Navy, was detailed as a member while the Board is considering searchlights for coast defense by letter of the Acting Secretary of the Navy, dated October 3, 1902. He was detached from this duty by letter of the Acting Secretary of the Navy, dated May 29, 1903.

Commander W. J. Barnette, U. S. Navy, was detailed as a member while the Board is considering the defense of coaling stations by paragraph 26, Special Orders, No. 278, Headquarters of the Army, A. G. O., November 26, 1902.

Col. Amos Stickney, Corps of Engineers, was detailed as a member by paragraph 19, Special Orders, No. 36, Headquarters of the Army, A. G. O., February 12, 1903.

Col. S. M. Mansfield, Corps of Engineers, was appointed brigadier-general, U. S. Army, February 20, 1903, and retired from active service on February 21, 1903.

Maj. Arthur Murray, Artillery Corps, was detailed as a member by paragraph 6, Special Orders, No. 128, Headquarters of the Army, A. G. O., June 2, 1903, vice Maj. Sedgwick Pratt, Artillery Corps, relieved as a member by the same order.

As at present constituted The Board of Engineers is composed of Col. Chas. R. Suter, Corps of Engineers, president; Col. Amos Stickney, Corps of Engineers; Lieut. Col. C. W. Raymond, Corps of Engineers; Lieut. Col. W. R. Livermore, Corps of Engineers; Commander W. J. Barnette, U. S. Navy (during defense of coaling stations only); Maj. Rogers Birnie, Ordnance Department; Maj. Arthur Murray, Artillery Corps; First Lieut. Edward H. Schulz, Corps of Engineers, recorder and disbursing officer.

In addition, the following Division Engineers are members of The Board of Engineers when matters pertaining to defensive works in their respective divisions are under consideration by the Board: Col. G. J. Lydecker, Corps of Engineers, Central Division; Col. O. H. Ernst, Corps of Engineers, Northwest Division; Col. D. P. Heap, Corps of Engineers, Pacific Division; Lieut. Col. W. H. Heuer, Corps of Engineers, Northern Pacific Division; Lieut. Col. H. M. Adams, Corps of Engineers, Gulf Division; Lieut. Col. J. B. Quinn, Corps of Engineers, Southeast Division.

In the past fiscal year the following officers of the Corps of Engineers in charge of engineering districts attended meetings of the Board in New York City in connection with the subjects indicated: Maj. C. F. Powell, acquisition of land for defense of eastern entrance to Long Island Sound; Maj. John Millis, revision of project for defense of Puget Sound; Capt. Harry Taylor, ammunition supply at Fort Worden, Puget Sound.

The Board has considered the various subjects referred to it during the past fiscal year by the Chief of Engineers.

* * * * *

During the past fiscal year the Board witnessed tests and made personal inspections of fortifications, etc., as follows:

Witnessed test of 10-inch Taylor-Raymond chain hoist, rear delivery, at Fort Strong, Mass., and also inspected the defenses of Boston Harbor, on July 15, 1902.

Witnessed test of new 6-inch ordnance truck in connection with 6-inch chain hoist, at Battery Hudson, and inspected batteries Duane and Ayres, Fort Wadsworth, N. Y., July 16, 1902.

Made preliminary inspection of entire line of defense covered by combined Army and Navy maneuvers in Narragansett Bay and Long Island Sound, August 26-30, 1902, inclusive, and from August 31 to September 6, inclusive, witnessed these maneuvers.

Inspected fortifications and sites for searchlights at Portland, Me., on November 12; in Boston Harbor, November 14; in Narragansett Bay, November 18, and in Long Island Sound, November 19-20, 1902.

Witnessed test of Taylor-Raymond 10-inch chain hoist, front delivery, at Fort Warren, Mass., on November 14, 1902.

Inspected fortifications and sites for searchlights in Hampton Roads, Va., on December 9, 1902.

Witnessed firing of 16-inch B. L. R. at Sandy Hook, N. J., on January 17, 1903.

Inspected fortifications and sites for searchlights at Galveston, Tex., April 7 and 8; at New Orleans, La., and mouth of Mississippi River, April 9 and 10; at Mobile, Ala., April 11; at Tampa, Fla., April 13;

at Key West, Fla., April 16, and at Pensacola, Fla., April 19 and 20, 1903.

Witnessed fire-control test at Fort Barrancas, Fla., and firing test at Forts Pickens and Barrancas, April 21 and 22, 1903.

Inspected fortifications and sites for searchlights at Savannah, Ga., May 18; at Port Royal Sound, May 19; at Charleston, S. C., May 20; at mouth Cape Fear River, May 21; at Washington, D. C., and Potomac River, May 22, and at Baltimore, Md., May 23, 1903.

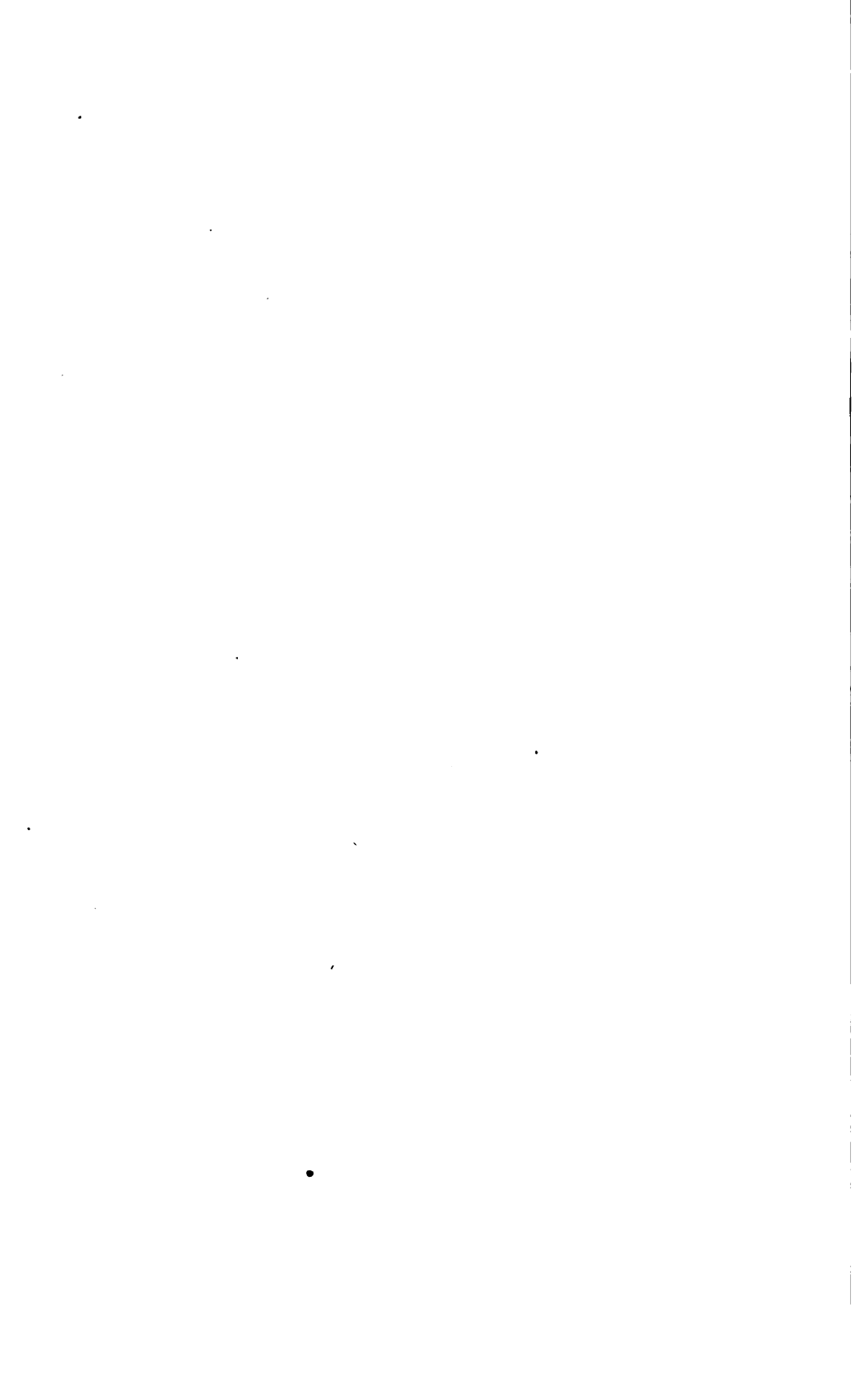
Witnessed test of 4½-inch harveyized steel shield for 6-inch barbette carriage, model 1900, at Sandy Hook, N. J., June 26, 1903.

For the Board:

Very respectfully, your obedient servant,

CHAS. R. SUTER,
*Colonel, Corps of Engineers,
President of the Board.*

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.



APPENDIX No. 2.

POST OF WASHINGTON BARRACKS, DISTRICT OF COLUMBIA—THIRD
BATTALION OF ENGINEERS—ENGINEER SCHOOL OF APPLICATION,
U. S. ARMY—ENGINEER DEPOT, WASHINGTON BARRACKS.

REPORT OF MAJ. EDWARD BURR, CORPS OF ENGINEERS, FOR THE
FISCAL YEAR ENDING JUNE 30, 1903.

ENGINEER SCHOOL OF APPLICATION,

U. S. ARMY,

Washington Barracks, Washington, D. C., July 31, 1903.

GENERAL: I have the honor to forward herewith, in duplicate, the annual report on the post of Washington Barracks, D. C., the Third Battalion of Engineers, the Engineer School of Application, U. S. Army, and the Engineer Depot, Washington Barracks, for the fiscal year ending June 30, 1903.

Very respectfully, your obedient servant,

EDWARD BURR,

Major, Corps of Engineers, Commanding.

Brig. Gen. G. L. GILLESPIE,

Chief of Engineers, U. S. A.

I.—POST OF WASHINGTON BARRACKS, DISTRICT OF COLUMBIA.

A concise description of this post will be found in the report of the preceding year, Annual Report, Chief of Engineers, 1902, page 793.

The improvement and enlargement of the reservation by the construction of new sea walls, the partial rebuilding of old walls, and the raising of lowlands by grading was in progress at the beginning of the year. The work on the sea walls has been completed. The grading by hydraulic dredging from the Washington channel continued throughout the year and is not yet completed; 362,906 cubic yards of material—sand, gravel, and clay—have been moved, to June 30, 1903, under the contract for this work.

The reconstruction of the post under authority of an appropriation made by Congress was commenced in the summer of 1902. The old buildings were entirely unsuited for post purposes, having been in nearly all cases remodeled from shops and warehouses. Their location was such that without an entire rearrangement of the post sufficient open space for drill purposes could not be made available. The

reconstruction of the post was further necessitated by its selection as the location of the building for the Army War College.

Tentative plans for the new post and for the Army War College were prepared during the previous year by a Board of Engineer officers. These plans were modified after consultation with Mr. C. F. McKim, of New York, and upon their presentation to Congress the work was authorized by an appropriation in the act of June 30, 1902, for beginning the work. The remainder of the estimated cost was appropriated in the act of March 2, 1903.

The rebuilding of the post upon plans prepared by Messrs. McKim, Meade, & White, of New York, and approved by the Chief of Engineers and the Secretary of War, was placed under the charge of Capt. J. S. Sewell, Corps of Engineers. Work upon the officers' quarters and one set of barracks for two companies was commenced in the summer of 1902, but much delay has been caused by poor foundations, unfavorable weather, and scarcity of men and materials. At the close of the year favorable progress was being made, although the existence of the buildings of the General Hospital upon the site of some of the most needed of the proposed new buildings will cause further delays in their completion.

The old buildings of the existing post are crowded and ill suited for their present purposes. Need has been especially felt for increased space in barracks, for the Engineer School of Application, including library and museum, and for the storage of engineer and quartermaster's materials. During June, 1903, one building occupied as barracks by two companies and the engineer band was, in order to clear the site of the War College, razed, with the exception of so much as was necessary to provide quarters for the band. It is expected that new barracks to replace those razed will be ready for occupancy by the time the four companies of the Second Battalion of Engineers are assembled here in January next.

The corner stone of the War College was laid on February 21, 1903, and the foundations for the entire building are under construction.

Ordinary repairs were made to the buildings on the post, but were only such as are necessary to maintain them in a habitable condition until the new buildings are completed.

There is no telegraph office on the post. Connection is made with the city of Washington over one telephone, and important official messages are received over the telephone, as well as by messenger from the city. The telephone service is insufficient and authority for an increased service has been granted, but this service has not so far been installed.

There is a local telephone system furnished by the Signal Corps. This system renders valuable service, but should be increased and remodeled to fully meet all requirements.

The mail facilities and the service of gas and water remain as stated in the last annual report.

Target facilities for the troops of the command are most unsatisfactory. Authority for the use of a range on the post up to 200 yards was granted by the Secretary of War, but the use of this range was discontinued by reason of the danger from ricochet shots. A 300-yard range was prepared in the ravine on the northeast side of the Fort Foote Reservation and was used during the firing seasons of 1902 and 1903. For firing beyond 300 yards use was made of the range at Ordway, Maryland, until general firing on that range was suspended in June, 1903, as the result of an accident from a chance wild shot. The

firing for the season of 1903 is therefore uncompleted, excepting for such men as it may be possible to send to more distant ranges.

Expertness in the use of the rifle is a most important element in the training of a soldier, and the experience of recent wars indicates strongly that the developments in modern small arms have accentuated the value of the expert rifleman. Suitable and convenient ranges owned or controlled by the United States should be provided for all troops, and the Regular Army should not be dependent upon the courtesy or convenience of any other organization for the facilities to give this most necessary training. The necessity for a Government rifle range conveniently located for the use of all troops stationed near Washington becomes more marked each year.

The post has been garrisoned during the year by the Third Battalion of Engineers. That battalion has been ordered to service in the Philippines and two companies (I and K) left the post on April 15, 1903. The other two companies are under orders to start on September 15, 1903. The Second Battalion replaces the Third, two companies arriving in July and the other two probably in January, 1904.

Officers of the Corps of Engineers on duty with the Third Battalion during the year are reported later. Other officers on duty at the post during the year have been the following:

Maj. H. P. Birmingham, Medical Department, since December 9, 1902.

Maj. Edward Burr, Corps of Engineers (promoted from captain January 29, 1903), June 30 to April 1, except during period August 1 to August 26, when assigned to duty with the battalion.

Capt. C. H. McKinstry, Corps of Engineers, entire year.

Capt. W. V. Judson, Corps of Engineers, relieved June 13.

Capt. J. H. Stone, Medical Department, until December 14, when relieved from post.

First Lieut. Wm. D. Connor, Corps of Engineers, September 19 to September 30, when relieved from post.

First Lieut. A. E. Waldron, Corps of Engineers, since April 21.

First Lieut. S. E. Lambert, Medical Department, September 17 to November 1.

SUBPOST OF FORT FOOTE, MD.

Fort Foote has not been garrisoned for a number of years, and was placed under the command of the commanding officer at Washington Barracks for drill purposes by the Secretary of War under date of November 26, 1901. A concise description of the reservation will be found in the last annual report (Annual Report, Chief of Engineers, 1902, p. 795).

The buildings are all old and are in general in a bad state of repair. They all are frame structures, built between 1868 and 1870, and the majority of them are entirely unserviceable in their present condition.

The water supply of the post was drawn from two springs and from cisterns holding rain water collected from the roofs of buildings. The analyses of the water from the springs during the previous year indicated it to be of excellent quality. The amount of water available from these sources is not, however, more than 1,200 or 1,500 gallons per diem, and the pump and tank for supplying it to the post have disappeared or become unserviceable. The cisterns are eight in number, but with the decay of the buildings they have ceased to be available as a source of water supply.

A rifle range for firing to 300 yards was prepared in the ravine on the northeast side of the reservation by clearing the ground and building butts and stands at the firing points.

Fort Foote furnishes fairly good facilities for some engineer drills that

can not be carried on at Washington Barracks. Much time is lost, however, in transporting troops to and fro, particularly with the inefficient means of transportation available. Companies have therefore been put into camp during the drill and target firing seasons.

Application was made in April, 1903, by the Twenty-second Regiment, Engineers, N. G. N. Y., for permission to camp upon this reservation, but the insufficiency of the water supply made it necessary to report unfavorably upon this application. It is hoped that arrangements can be made to supply a regimental camp with sufficient water for ten days before the end of the next fiscal year.

No work was done at Fort Foote during the year excepting the preparation of a target range, minor repairs to roads and wharf, and the cleaning of cisterns, all by the labor of troops.

II.—THE THIRD BATTALION OF ENGINEERS.

The Third Battalion of Engineers, consisting of Companies I, K, L, and M, formed the garrison of the post until April 15, 1903.

Three companies, K, L, and M, took part in the combined Army and Navy maneuvers at New London, their principal duties being in connection with the searchlights, though in addition thereto they performed such engineering duties as were considered necessary.

Company M at Fort Terry constructed and manned a 5-inch battery; a detachment of Company M at Fort Michie was used for searchlight work and for manipulating the horizontal base outfit.

At Fort Wright, Companies K and L had charge of the searchlights and formed the gun detachments for the movable armament. A detachment of men from Companies I and K was sent to Fort Mansfield to place in order the electrical plant at that post, which had been reported as unfit for service by the artillery. The plant was repaired and run without any delays during the period of the maneuvers.

TARGET PRACTICE.

The practice was carried on through the regular season and was extended through the month of October by authority of the department commander.

This being the first regular practice of the battalion, the results were not as good as could be desired. The lack of a good range was also badly felt. Practice at 100, 200, and 300 yards was carried on at the subpost of Fort Foote; beyond the 300-yard range practice was had at the Ordway range, this range being rented for the purpose from the District of Columbia National Guard. One man from each company attended the department competition, two of these men being afterwards selected as members of the department team.

In a competition at the Ordway range with teams from the United States Marines, the United States troops at Fort Myer, and the District of Columbia National Guard, a skirmish team from the Third Battalion was the winner.

Too much stress can not be laid on the necessity of a good Government range in this vicinity for use of the United States troops. The only range in the neighborhood is the Ordway range, which is far from being an ideal one, and which, due to its use at all times by the District of Columbia National Guard, can hardly be considered as available for use by United States troops. During the current season

it was found to be impossible to arrange a schedule so that the Engineer troops could fire on the range, the result being that the troops will probably be unable to complete their target practice. Moreover, when the range can be used, it is available for such a short time that the men must be hurried through, and such a thing as individual practice is unheard of. This is not conducive to encouraging the spirit necessary for good practice by the troops.

During the current season practice at 200 and 300 yards has been held at Fort Foote, but beyond the latter range there is little prospect for practice except probably for a few men in each company.

DRILLS.

The following schedule of drills has been followed during the months indicated, so far as practicable:

July-October.—Practice marches; engineer drills to include road making, demolitions, siege works, types of trenches, revetments, bomb-proofs, saps, magazines, railroad construction, construction of trestle bridges and wharves; reconnaissance and photography for selected men. Most of the drills were held at Fort Foote, the companies alternating in going into camp at that place.

November-March.—Until stopped by inclement weather: Practice marches; stone and concrete masonry; heavy timber construction; military mines and demolitions; ponton-bridge work, including instruction in rowing; instruction in riding, reconnaissance, photography, and use of surveying instruments for selected men. Trade-school instruction in carpentry; management of steam plant; plumbing; masonry; blacksmithing; machine-shop work; photography; drafting; printing.

After inclement weather prevented regular outdoor work: Instruction in knots, lashes, and splicing; manual of arms; bayonet exercise; gymnastics; calisthenics; wall scaling; fire drill; litter drill and first aid to the wounded; packing; signaling; moving heavy weights; riding; general instruction in rough carpentry and blacksmithing. Theoretical instruction in the afternoon for selected men in drill regulations; guard duty; firing regulations; practical military engineering; troops in campaign; service of security and information; hippology and trade-school instruction, as previously noted.

Post school for enlisted men between the months of November and February, inclusive, in which instruction was given in spelling, reading, writing, geography, grammar, United States history, arithmetic, geometry, algebra, trigonometry, etc.

On April 15, 1903, Companies I and K left this post for San Francisco en route to the Philippines under command of Maj. C. McD. Townsend, Corps of Engineers, who will command the battalion after September 15, 1903. The other two companies, L and M, are under orders to start on September 15 for the same destination.

The following officers of the Corps of Engineers have been on duty with the battalion during the year:

Maj. Wm. M. Black, commanding from July 1 to August 1 and from August 26 to April 1, when relieved from post.

Maj. Edward Burr (promoted from captain January 29, 1903), commanding from August 1 to August 26 and from April 1 to June 30.

First Lieut. F. C. Boggs, adjutant entire year.

First Lieut. Wm. D. Connor, quartermaster and commissary to September 19, when placed on special duty under post commander.

First Lieut. T. H. Jackson, quartermaster and commissary since September 19.

COMPANY I.

Capt. Spencer Cosby, since April 1.

First Lieut. Wm. J. Barden, September 11 to April 15, when relieved from post.

First Lieut. T. H. Jackson, July 1 to September 19, when assigned quartermaster and commissary.

First Lieut. E. M. Adams, since January 23, also temporarily attached August 2 to September 13.

First Lieut. J. R. Slattery, January 7 to February 1, when transferred to Company M.

First Lieut. A. B. Putnam, July 1 to March 25, when transferred to Company L.

First Lieut. P. S. Bond, November 4 to January 8, when transferred to Company M.

First Lieut. J. H. Poole (promoted from second lieutenant February 20, 1903), entire year.

COMPANY K.

Capt. Charles Keller, since April 1.

Capt. Charles W. Kutz, July 1 to March 14, when relieved from post.

First Lieut. E. M. Rhett, January 23 to April 10, when transferred to Company M.

First Lieut. A. E. Waldron, July 1 to March 25, when transferred to Company M.

First Lieut. W. P. Stokely, since April 11.

Second Lieut. H. C. Jewett, entire year.

Second Lieut. Mark Brooke, September 30 to March 25, when transferred to Company M.

COMPANY L.

Capt. J. F. McIndoe, entire year.

First Lieut. William Kelly, February 1 to April 24, when relieved from post.

First Lieut. E. M. Rhett, July 1 to January 23, when transferred to Company K.

First Lieut. A. B. Putnam, March 25 to April 30, when relieved from post.

First Lieut. M. J. McDonough, to April 15, when relieved from post.

First Lieut. E. N. Johnston (promoted from second lieutenant December 23, 1902), from December 8 to June 30.

Second Lieut. Wm. L. Guthrie, from September 30 to June 30.

COMPANY M.

Capt. M. L. Walker (promoted from first lieutenant December 23, 1902), entire year.

First Lieut. E. M. Adams, July 1 to January 23, except when temporarily attached to Company I, August 2 to September 13; transferred to Company I January 23.

First Lieut. E. M. Rhett, April 10 to June 4, when resignation as officer in Army was accepted.

First Lieut. J. R. Slattery, February 1 to April 24, when relieved from post.

First Lieut. A. E. Waldron, March 25 to April 21, when placed on special duty under post commander.

First Lieut. P. S. Bond, January 8 to June 30.

First Lieut. W. P. Stokely, until April 11, when transferred to Company K.

Second Lieut. Mark Brooke, March 25 to April 7, when relieved from post.

Second Lieut. J. F. Bell, since September 30.

III.—ENGINEER SCHOOL OF APPLICATION, U. S. ARMY.

Maj. Wm. M. Black, Corps of Engineers, Commandant to April 1, 1903.

Maj. Edward Burr, Corps of Engineers, Commandant since that date.

The general regulations for the school are to be found in the Army Regulations and in General Orders, Nos. 146 and 155, Headquarters of the Army, series of 1901. In accordance with letter from the Adjutant-General of the Army, dated October 27, 1902, the supervision of the work of the school was placed directly under the Army War College Board, while for purposes of administration and police control the post of Washington Barracks remains under the orders of the commanding general of the Department of the East.

Regular instruction for the season of 1902-3 was begun on November 1, 1902, and was continued until April, when, on the recommendation of the Chief of Engineers, approved by the War College Board, the Secretary of War suspended instruction of officers at the school for the period of one year. This recommendation was made by the Chief of Engineers in view of the urgent need of officers of the Corps of Engineers for other duties.

The period of instruction being for two years, the student officers are naturally divided into two classes, known as the first winter's class and the second winter's class, respectively.

The following statement shows the course of instruction as approved by the Chief of Engineers and the Army War College Board:

A.—DEPARTMENT OF MILITARY ENGINEERING, INCLUDING ORDNANCE AND ARMOR.

Instructor, Capt. William V. Judson, Corps of Engineers.

On the original programme fifteen weeks was allotted to this department, the period of instruction extending from January 8, 1903, to April 22, 1903.

The programme included:

War ships: classification, construction, armor, armament, maneuvering, power, etc.; influence of sea power upon land operations, including combined movements (Revolutionary war, Trafalgar, Nile, etc.); mortars and explosives; coast fortifications: general principles, location, construction, attack, and defense; land fortifications: permanent, semipermanent, and hasty; general principles, use of attack and defense; service of security and information; organization and tactics, especially dwelling upon engineer organization, equipment, and formations; studies of terrain; tactical problems and logistics, with maps, kriegsspiel methods, and in the field study of campaigns.

Due to the assignment of the officers in this class to duty with the companies which were under orders to proceed to the Philippine Islands, to leave April 15, authority was obtained to so consolidate the course that the student officers could finish by April 1.

In addition to the programme outlined above, the student officers were taken for instruction purposes to Fort Monroe and to the battlefield of Gettysburg. As a part of the examination each student officer was required to prepare a project for the defense of some specific harbor.

B.—DEPARTMENT OF CIVIL ENGINEERING.

Instructor, Capt. Charles H. McKinstry, Corps of Engineers.

Under the subjects roofs, bridges, and building construction, the first winter's class was instructed by Maj. Edward Burr, Corps of Engineers.

Civil engineering is included in the course for both winter classes.

The course for the first winter's class began February 5 and ended April 20.

Details of the course, ordered upon the recommendation of the academic staff, were as follows:

Surveying; roads and railroads; building construction: roofs and bridges, including graphical statics; foundations and masonry; concrete: general principles, manufacture, and uses; cement: manufacture, test, and use; water supply.

The course of instruction for the second winter's class began November 3, 1902, and ended January 7, 1903.

The details of the course were as follows:

Water supply; sewage disposal; accounts, etc.; river and harbor improvements: thesis.

C.—DEPARTMENT OF ELECTRICS, INCLUDING MECHANICS.

Instructor, Maj. Edward Burr, Corps of Engineers.

The period covered by this course was from November 3, 1902, to February 4, 1903.

The detailed programme follows:

Electrical engineering, eight weeks, began November 3, 1902, and ended January 7, 1903, as follows:

General principles of magnetism, electricity, induction, etc.; direct-current apparatus, dynamos, motors, etc.; general principles, construction, and management: alternating current; storage batteries: construction, application, and management; measuring instruments; switch boards and appurtenances; transmission of electrical energy; selection of system and voltage; determination of size of copper; details of line construction, overhead and underground; arc and incandescent lamps of all kinds; searchlights: construction, selection, efficiency, testing, and use; miscellaneous applications of electricity, including telephones, telegraphs, wireless telegraphs, telautographs, etc.; practical problems and theses. Laboratory work will be carried on throughout the course in connection with the theoretical instruction.

Mechanical engineering, four weeks, began January 8, 1903, and ended February 4, 1903, as follows:

Steam engines and boilers; gas and oil engines; pumps, dredges, hoisting and conveying machines, and general construction plant.

Owing to the suspension of instruction no practical instruction was given in photography, reconnaissance and astronomy.

On his application, approved by the academic staff, the War College Board and the Secretary of War, Lieut. F. C. Boggs, adjutant of the battalion, was authorized to complete that portion of the course at the school of application which he had not completed when he was appointed adjutant. Lieutenant Boggs finished the course, and was granted a diploma.

The following-named officers, having during the year finished the entire course, were granted diplomas:

Lieuts. F. C. Boggs, E. M. Adams, E. M. Rhett, J. H. Poole, and H. C. Jewett

The following table shows the work completed by the student officers to June 30, 1902:

[c., completed and recommended proficient; n. c., begun, but not finished; c. h., completed and recommended proficient with honor.]

Names.	Theoretical instruction.					Practical instruction.			Date of joining.	Date of relief from school.	Remarks.
	Electrics.	Mechanics.	Civil engineering.	Military engineering.	Surveying.	Astronomy.	Reconnaissance and photography.				
Winter's course.											
1st.	1st.	1st.	2d.	2d.							
<i>First lieutenants.</i>											
F. C. Boggs	c.	c.	c.	c.	c.	c.	c.	c.	-----	June 7	Completed course by special authority.
Wm. Kelly	-----	-----	c.	-----	-----	-----	-----	-----	Jan. 31	Apr. 24	
E. M. Adams	c.	c.	c.	c. h.	c.	-----	-----	-----	-----	Apr. 1	
E. M. Rhett	c.	c.	c.	c. h.	c.	c.	c.	c.	-----	do	
J. R. Slaterry	-----	c.	c.	-----	-----	-----	-----	-----	Jan. 7	Apr. 24	
A. B. Putnam	c.	c.	c.	-----	-----	-----	-----	c.	-----	Apr. 20	
A. E. Waldron	c. h.	c. h.	c.	-----	-----	-----	-----	c.	-----	Apr. 21	
M. J. McDonough	c.	c.	-----	-----	-----	-----	-----	c.	-----	Apr. 15	
P. S. Bond	c.	c.	c.	-----	-----	-----	-----	-----	Nov. 14	Apr. 20	
W. P. Stokey	c.	c.	-----	-----	-----	-----	-----	c.	-----	Apr. 15	
E. N. Johnston	c.	-----	c.	-----	-----	-----	-----	-----	Dec. 6	Apr. 20	
J. H. Poole	c.	c.	c.	c. h.	c.	c.	c.	c.	-----	Apr. 1	
<i>Second lieutenants.</i>											
H. C. Jewett	c.	c.	c.	c. h.	c.	c.	c.	c.	-----	Apr. 1	-----
W. L. Guthrie	c.	c.	c.	-----	-----	-----	-----	-----	Sept. 30	Apr. 20	
Mark Brooke	c.	c.	-----	-----	-----	-----	-----	-----	do	Apr. 7	
J. F. Bell	c.	c.	c.	-----	-----	-----	-----	-----	do	Apr. 20	

During the year such progress has been made in equipping the electric laboratory that, with the resumption of instruction at the school, a thorough practical as well as theoretical course can be given in that branch. In addition, a small locomotive has been procured for the use of the school, and negotiations are in progress for the purchase of a small steamboat. This boat is so designed that it can be shipped in sections on an ordinary transport, and it is thought that with it much useful information can be obtained on the subject of landing troops and impedimenta.

During the year much of the time of the instructors has been spent on duties ordered by higher authority, but not directly connected with the school.

In connection with the school work the instruction of selected enlisted men of the battalion in various mechanical trades was carried on between the months of November, 1902, and April, 1903, inclusive. For a detailed statement of this work attention is invited to the report of the commandant of the school for the year 1902. (Annual Report Chief of Engineers, 1902, Appendix 3.)

Special attention has been given to the subject of photography and map reproduction, with particular reference to definite equipments for field work for both an engineer company and battalion headquarters.

Mr. C. F. O'Keefe, formerly a captain in the Thirty-sixth United States Volunteers, was employed for this special purpose. Captain

O'Keefe was in charge of the photographic outfit of the engineers in the Philippine Islands and was in the same capacity with the China relief expedition, and consequently could bring to bear on the question much practical as well as theoretical knowledge.

The following company equipment was recommended by him, and will be given practical field test in the Philippine Islands by two of the companies of engineers under orders to proceed to that station.

Photographic outfit for one company of engineers.

- | | |
|--|---|
| 1 camera, graphic, reversible back, 5 by 7 inches, complete. | 50 packages Pyro developing powder. |
| 1 tripod for the above. | 1 bottle acetic acid, c. p., 32 ounces. |
| 1 cartridge roll holder, 5 by 7 inches. | 25 pounds hypo soda, granular. |
| 5 plate holders, 5 by 7 inches, for above camera. | 10 pounds sulphite of soda, c. p. |
| 5 film holders, 5 by 7 inches, for above camera. | 10 pounds carbonate of soda, c. p. |
| 2 yards rubber tubing. | 10 pounds alum, powdered. |
| 2 rubber bulbs. | 6 ounces pyrogalllic acid, c. p. |
| 1 brush, paste, 2-inch. | 3 ounces bromide of potassium, c. p. |
| 1 brush, dusting, 2-inch. | 20 pounds salt. |
| 4 frames, printing, 5 by 7 inches. | 24 boxes nepera acid fixing powders. |
| 1 frame, printing, 16 by 20 inches, with pad and glass. | 1 pound glycerin. |
| 1 tray, zinc, 12 by 17 inches. | 1 pound citrate of iron and ammonia, c. p. |
| 1 tray, zinc, 17 by 20 inches. | 2 brushes, spotting. |
| 1 tray, zinc, 20 by 24 inches. | 1 pound ferricyanide of potassium, c. p. |
| 1 tray, zinc, 24 by 30 inches. | 1 retouching frame. |
| 4 trays, agate iron, 5 by 8 inches. | 1 hydrometer. |
| 1 glass, graduated, 16 ounces. | 1 set scales, with weights, Fairbanks's photo. |
| 1 tube photo paste, 4 ounces. | 1 dark-room box. |
| 4 round bottles, 32 ounces each, with glass stoppers. | 2 lanterns, complete with globes. |
| 3 dozen United States photo clips. | 2 globes, extra, for the above. |
| 50 sheets blotters, photo. | 1 stick india ink. |
| 1 yard dark-room fabric, red. | 2 rolls blue-print paper, 30-inch, 10 yards. |
| 1 yard dark-room fabric, yellow. | 2 rolls unprepared blue-print paper, 30-inch, 10 yards. |
| 4 dozen kodak push pins. | 2 rolls blue-print paper, 30-inch, 50 yards. |
| 1 focusing cloth, 5 by 5 feet. | 1 bottle liquid drawing ink, black, $\frac{1}{2}$ pint. |
| 1 developing box, Eastman's, for 7-inch films. | 3 crow-quill pens, with holders. |
| 2 gross sheets self-toning paper, 5 by 7 inches. | 2 water buckets, canvas. |
| 12 rolls cartridge films, Eastman's, 5 by 7 inches. | 1 sewing outfit. |
| 12 dozen cut films, Seed's, 5 by 7 inches, No. 26X. | 1 table, folding. |
| 2 gross sheets Velox paper, 5 by 7 inches. | 2 camp stools, folding. |
| 24 boxes developing powder, 5 tubes. | 4 candlesticks, brass. |
| | 1 hammer, tack. |
| | 1 package tacks, 4 ounces. |
| | 2 notebooks. |
| | 2 fans, paper. |
| | 1 rubber stamp (Co. L, Engineers). |
| | 1 pad for rubber stamp. |

No really satisfactory map-reproducing outfit has been found, though several have been tried. For semipermanent stations the method of zincography has been decided to be that most nearly suitable, and a small press (about 150 pounds), capable of giving a sheet 17 $\frac{1}{2}$ by 22 inches, has been purchased for future experiments. It is thought that this may be so packed that it can be used with the headquarters of an army, but experiments made thus far are insufficient to settle the question, especially as the subject of pack transportation has been taken out of the hands of this school.

For use with a company in the field some process similar to the hectograph, but giving a permanent record, is extremely desirable, but as yet no suitable process has been found.

ENGINEER FIELD MANUAL.

Work was continued on the manual by the members of the academic staff during such time as could be spared from their regular duties. This work consisted mainly in a revision of chapter 1, on "Reconnaissance."

During the month of April the preparation of the manual was transferred to the commanding officer of the First Battalion of Engineers, at Fort Leavenworth. All papers relating to this work were sent to the officer designated.

MISCELLANEOUS.

When the Engineer School occupied this post in October, 1901, upon its transfer from Willets Point, N. Y., it was practically without any of the equipment necessary for school purposes and the balances of available funds permitted only the purchase of the most urgently needed supplies. The act of June 30, 1902, contains an item of \$45,000 for the expenses of the school for the fiscal year 1903, and the project covering the expenditure of this appropriation was approved by the War College Board on September 20, 1902. Under this project there have been purchased such furniture as was necessary for the proper equipment of offices and class rooms, as well as the current supplies required for the conduct of the school. Much progress has also been made in the equipment of laboratories and workshops. The trade school, in which instruction is given to the enlisted men of the engineer battalion on duty at this post, was supplied with the necessary hand tools in the carpenter, mason, plumbing, and blacksmith shops, and the machine shop was provided with an engine lathe, pattern-maker's lathe, drill press, bolt cutter, shaper, emery grinder, and band saw, all of the most modern type and driven by electric motors furnished with power from the electrical laboratory.

With funds allotted from the school appropriation and an allotment of \$6,300 from the emergency fund, War Department (act of March 3, 1899), an excellent beginning has been made in the equipment of a laboratory for practical instruction in electricity. The purchases for this laboratory during the year include a storage battery; an experimental AC-DC machine, with a suitable motor for operating it; a 15 K. W. direct-connected generating set, and a 25-horsepower horizontal automatic engine. In addition to the above machines, there was transferred to the school, for use in the laboratory, a 36-inch searchlight outfit, including searchlight, oil engine, and generator, and an assortment of ammeters, voltmeters, and wattmeters has been provided in sufficient variety to meet all present requirements.

Many additions were also made to the equipments of the printing office and the photographic laboratory, including for the latter an electric blueprint outfit.

Two hundred bound volumes of periodicals and miscellaneous books were added to the library, and two small libraries of technical works were purchased from school funds and issued to the First and the Third Battalions of Engineers. Steps have been initiated for applying the card-index system to the library of the Engineer School.

The necessary labor for carrying on the work of the school has been obtained from both civilian employees and enlisted men detailed on extra duty and receiving extra-duty compensation for their services. The erection and supervision of electric and other machinery was in

the charge of a civilian machinist, and an expert electrician was employed for three months upon the installation of the electrical laboratory.

The following pamphlets were printed at the Engineer School and distributed during the year:

Upon the Use of Electric Searchlights in War. (Translated from *Revue du Génie Militaire*, November and December, 1901, by Capt. W. V. Judson, Corps of Engineers.)

The Improvement of the Mississippi River between St. Louis and Cairo, by First Lieut. William P. Wooten, Corps of Engineers.

Military Landscape Sketching, by M. Lefebvre. (Translated from the *Journal des Sciences Militaires*, by Capt. W. V. Judson, Corps of Engineers.)

The Destruction of Obstacles in Campaign, by Major Bornecque, with 42 illustrations in the text. (Translated from the French by Capt. (now major) Edward Burr, Corps of Engineers.)

The work of the school was more or less hampered during the year through not having sufficient space for all purposes in the buildings now in existence on this post. The office and class-room facilities were fairly satisfactory for their purposes, but there is insufficient space for the library of the school and no room at all available for the use of the school museum and for setting up the many valuable models belonging to it. Under the plans approved for the reconstruction of this post sufficient space for all the above purposes will be provided in the future.

IV.—ENGINEER DEPOT.

1. PUBLIC BUILDINGS, BOATS, CONSTRUCTIONS, ETC.

During the year no new permanent buildings for the use of the Engineer Depot have been constructed. The depot property transferred to Washington Barracks, D. C., from Willets Point, N. Y., during the previous fiscal year and the early part of this year was, in the absence of proper storage buildings, placed in the old gun shed, in stables, magazines, and in the basement of one of the barracks, where it is under proper shelter and stored according to classes as far as practicable. While this property is protected from the weather, it is not entirely secure against fire or theft and is in much confusion, but this condition can not be bettered until new storage facilities for the Engineer Depot and School are provided in connection with the reconstruction of this post.

The old gun shed, near the site of the new war college building, was used as the principal storehouse and workshop for the depot property and depot work until last spring, when it had to be abandoned on account of the filling in of the low lands surrounding it. New storage room was provided by raising, repairing, and fitting up an old frame stable on the east side of the post, and all the property formerly in the gun shed was transferred to this building, which, although of insufficient capacity and not at all suited for the purpose, is the only one now available.

A small frame building, east of the academic building, was constructed from materials on hand for use as an astronomical observatory, but after the suspension of instruction of officers at the school the astronomical outfit was removed to the depot storehouse and the building was fitted up for the storage of stationery and drawing materials.

A temporary frame building was erected north of the academic building, for use as a temporary power house for the electrical labo-

ratory of the school and for housing a locomotive until permanent quarters are provided.

Incidental repairs to buildings used for depot and instruction purposes, putting up shelving, etc., have been made from time to time when required.

The small naphtha launch received here during the previous fiscal year from Pensacola, Fla., was overhauled and repaired. The copper coil was renewed and the launch placed in service last season.

Two 20-foot and one 18-foot yawl boats were bought under proposals.

At the close of the fiscal year provision was made for the storage in a small building at the south end of the post, and formerly used as a stable guardhouse, of the large number of surveying instruments which have been turned into this depot under recent instructions from the Chief of Engineers. The building is a substantial brick structure, large enough to hold all the instruments on hand. Necessary shelving and other fixtures were put up, and all the surveying, astronomical, and other instruments were transferred to it.

2. WORK OF THE DEPOT.

The general work of the depot included the care of all the depot property, such as tools, implements, materials, ponton and bridge equipage, instruments, electrical appliances, steam machinery, intrenching tools, models, etc., transferred to this post from Willets Point, N. Y., and bought during the past and present fiscal years.

The care of the depot property and the work connected with the same was under the charge of a civilian storekeeper engaged early in the present fiscal year. The working force consisted of civilian mechanics and laborers employed from time to time as their services were required, and of enlisted men of the engineer battalion, detailed on special duty and receiving extra-duty compensation, at such times and periods that these details did not interfere with their regular duties as engineer soldiers.

The purchase and issue of tools and materials needed for the instruction of engineer troops in their special duties, including ponton and bridge materials, intrenching tools, tools and materials for use in the trade school, etc., continued throughout the year.

The large amount of miscellaneous property received here from Willets Point, N. Y., during the previous fiscal year required continuous care and labor for cleaning and preserving, assorting and classifying, and the separation of the serviceable from the unserviceable material, and this work will be continued in the new fiscal year. Some 10,000 shovels, picks, spades, etc., the wooden handles of which became infected with a species of woodworm, were treated with kerosene oil, and at the same time all the metal parts of these tools were cleaned from rust and oiled. The worms in the handles appear to have been exterminated by the use of the kerosene-oil bath, as no further signs of wood dust have been found.

No storage room has as yet been provided for the reception of the engineering models brought here in 1901 from Willets Point, N. Y. Most of the models are yet in the original packing boxes, and are stored in an unoccupied stable building at the south end of the post.

Two companies of the Third Battalion of Engineers were equipped by the depot with the necessary tools and materials for service in connection with the Army and Navy maneuvers held during July and August of 1902. Shipment of 3,300 sand bags was made in August to engineer officers participating in the maneuvers.

A large amount of unserviceable property which had accumulated in the depot during the year was disposed of in accordance with regulations.

Under the approved detailed project for the expenditure of the allotment of \$7,500 from the appropriation for "Engineer Depot," 1903, for "Incidentals," purchases were made from time to time of various materials and tools needed in connection with the general work of the depot as well as for repairs to buildings, shops, offices, ponton and bridge equipage, and miscellaneous implements.

The more important articles purchased were as follows:

1 12-inch Oliver typewriting machine.	2 flat-top office desks.
2 small typewriter desks.	6 office chairs.
2 typewriter revolving chairs.	1 catalogue filing cabinet.
20,000 feet B. M. assorted lumber.	1 diaphragm pump.
5,000 pounds assorted manila rope.	1 set single harness.

3. DEPOT INSTRUMENTS.

The general work of caring for the large accumulation of surveying, astronomical, and other instruments was performed by the depot employees.

No purchases of instruments for the depot were made, funds for that purpose not having been assigned to this office.

Under the requirements of Circular No. 21, Office of the Chief of Engineers, October 4, 1902, shipments of miscellaneous surveying instruments were received in the depot from time to time during the year. With but a few exceptions no serviceable instruments were so received. The necessary repairs to instruments have been made in this city, and the instruments then placed in the depot ready for issue on duly approved requisitions.

Minor repairs to instruments and electrical appliances were made in the depot, and larger instruments, such as transits, levels, etc., have been sent to repair shops. It was noted that repairs to instruments have been very satisfactorily accomplished in this city, and it is thought that the prices charged for such repairs were more reasonable than the rates paid when the depot was located at Willets Point, N. Y.

An allotment of \$500 from the appropriation for "Engineer Depot, 1903," for "Instruments," and a subsequent allotment of \$500 from the appropriation for "Examinations, Surveys, and Contingencies of Rivers and Harbors," were limited solely to the repair of instruments. Both these sums were expended during the year and were mainly applied to the instruments received from Willets Point, N. Y.

The following itemized table^a gives the number of instruments repaired during the year. The total cost of repairs was \$1,000.

A number of other instruments, such as transits, levels, current meters, etc., were repaired during the year and the bills for the work sent for payment to the officer to whom they were issued.

Issues of instruments and drawing materials were made during the year to officers engaged on public works and surveys, engineer officers at headquarters of the military departments, and to post engineer officers in the United States and in the Philippines.

The following itemized table^a gives the kinds and quantities of instruments issued. The total number issued was 1,062.

During the year the following instruments^b were turned into the

^a Not printed.

^b List not printed.

depot by officers in charge of public works and surveys, acting engineer officers, and by the officer in charge of the purchase and repair of instruments at New York, N. Y. The total number turned in was 508.

A number of large and small instruments rendered unserviceable during long use have been inspected and condemned.

An outfit of large and small instruments and drawing materials was prepared and issued to a detachment of engineer troops from this post engaged in a survey of the grounds of the Soldiers' Home at Washington, D. C.

Purchases, issues, and repairs of instruments and drawing materials required for the engineer equipment of troops for use in the field are referred to hereafter under the heading "Engineer equipment of troops."

4. ENGINEER EQUIPMENT OF TROOPS.

Under the approved detailed project for the expenditure of the allotments made by the Chief of Engineers, U. S. Army, amounting in all to \$8,787.19, from the appropriation for "Engineer Equipment of Troops," fiscal year 1903, purchases were made from time to time of various engineer materials, field-photographic supplies, and experimental tools and lumber for making various new designs of trestles and other parts of the ponton-bridge equipage.

The following more important supplies were bought and delivered during the year.^a

Materials, tools, and implements of all descriptions required for field service of the four companies of the Third Battalion of Engineers, under orders to proceed to the Philippines, have been procured, and issues were made to Companies I and K, which left for the Philippines on April 15. The engineer equipment issued to these companies during the previous fiscal year was completed by the purchase of such supplies as are expended in current use, and the instruments pertaining to these companies were overhauled and repaired. In addition to the regular supplies, the two companies were furnished with a complete field-photographic outfit.

All the tools and supplies intended for the remaining two companies, L and M, are on hand and will be issued early in the next fiscal year.

In addition to the foregoing supplies, various articles required for experimental use, with a view to their adoption as a part of the engineer equipment of troops in the field, have been bought from time to time. These purchases include saws and special handles therefor, leather pouches for mattocks and small shovels, measuring tapes, canvas pouches, crowbars, hatchets, and various lots of lumber for use in making experimental trestles and other parts of the ponton equipage.

Under the last allotment, made in May, 1903, proposals were invited for 125 dozen of each of special pattern small-sized shovels and pick mattocks. The bids received admitted the purchase of 140 dozen shovels and 150 dozen pick mattocks, and the pick mattocks were delivered during the fiscal year. The shovels have been contracted for, and are to be delivered early in the next fiscal year.

The following table^b gives the articles issued during the year to engineer organizations for use in the field. The total number issued was 10,601.

^aList not printed.

^bNot printed.

The following instruments^a pertaining to engineer troops have been repaired during the year. The total cost of repairs was \$39.65.

In addition to the routine work of the depot, much time and attention were devoted to the development of various parts of the engineer equipment of troops. An expert photographer was employed for six months, and his work resulted in the development of a field photographic equipment for engineer companies and battalions. Equipments for four companies and one battalion were purchased for issue to troops.

Many experiments have been made with various intrenching tools submitted for trial, in continuation of similar work during the previous fiscal year. The result of these experiments indicates that for hasty intrenchment and to be carried upon the person of the soldier no tool gives better results than the knife bayonet of the present infantry equipment and the meat can or tin cup. For heavier work a small shovel and a pick mattock of satisfactory design have been decided upon and accepted by the Board of Ordnance and Fortification. These tools are primarily intended to be carried in the company or other transportation, but when provided with suitable pouches and slings can be carried upon the person of the soldier in case of necessity.

Several forms of sketching case have been submitted for trial, and some of these experimental instruments have yet to receive a satisfactory service test.

Much time and thought have been given to the material of the bridge equipage. With the passing of the white-pine forests it is no longer practicable to obtain balk and chess of this lumber, which has so many desirable qualifications for the purpose, and of which the standard bridge equipage has been so largely built. Investigations to determine the most suitable material to replace white pine are under way, and include the test of Georgia pine, Oregon fir, poplar, and cypress. Experiments have also been made with composite balk of steel and wood. No conclusion has yet been reached as to a proper substitute for white pine, and until a satisfactory substitute is determined upon it will be impossible, for economical reasons, to increase the amount of bridge equipage in store. The balk and chess of bridge equipage are specified to be of clear white pine. Circular notices issued during the past and previous fiscal years failed to bring forth any proposals for either balk or chess of this grade of lumber. Some chess were purchased toward the end of the fiscal year of select white pine that are satisfactory for the purpose, but the cost of this material is excessive.

The two divisions of bridge equipage in store at the depot have been overhauled, and such repairs have been made to all of its component parts as are necessary to maintain it in serviceable condition.

Many reports have also been prepared and submitted upon the location and capacity of engineer depots, and upon the instruments, tools, and materials required for the engineer equipment of various organizations.

^a List not printed.

STATEMENT OF FUNDS.

I. Engineer Depot at Willets Point, N. Y., fiscal year 1902, for Washington Barracks.

1. For incidentals:

July 1, 1902, balance unexpended		\$139.87
June 30, 1903, amount expended during fiscal year ..	\$139.81	
June 30, 1903, amount turned into the Treasury during the fiscal year	.06	
		<u>139.87</u>

2. For materials:

July 1, 1902, balance unexpended		58.57
June 30, 1903, amount expended during fiscal year ..	\$54.97	
June 30, 1903, amount turned into the Treasury during fiscal year	8.60	
		<u>58.57</u>

3. For library:

July 1, 1902, balance unexpended		85.50
June 30, 1903, amount expended during fiscal year ..	\$84.23	
June 30, 1903, amount turned into the Treasury during fiscal year	1.27	
		<u>85.50</u>

II. Engineer Depot, fiscal year 1903.

From the sums appropriated by Congress for the fiscal year ending June 30, 1903, the following amounts were allotted by the Chief of Engineers, U. S. Army, for use at Washington Barracks, D. C.

1. For incidental expenses of the depot (incidentals)	\$7,500.00
2. For purchase and repair of instruments (instruments)	500.00

Total	8,000.00
-------------	----------

Of this there has been expended:

	Expended.	Pledged.	Total.
1. For incidental expenses of depot (incidentals)	\$6,886.64	\$633.36	\$7,500.00
2. For purchase and repair of instruments (instruments)	500.00		500.00
Total	7,386.64	633.36	8,000.00

III. United States Engineer School, Washington, D. C., fiscal year 1903.

Congress appropriated for the fiscal year ending June 30, 1903, the following sums for the United States Engineer School at Washington Barracks, D. C.:

1. For equipment and maintenance of the school (equipment and maintenance)	\$40,000.00
2. For providing means for the theoretical and practical instruction of the school (library)	5,000.00

Total	45,000.00
-------------	-----------

Of this there has been expended and pledged:

	Expended.	Pledged.	Total.
1. For equipment and maintenance of the school (equipment and maintenance)	\$19,435.27	\$20,314.72	\$39,749.99
2. For providing means for the theoretical and practical instruction at the school (library)	4,828.60	171.40	5,000.00
Total	24,263.87	20,486.12	44,749.99
Balance unexpended and available for contingent expenses attending the completion of contracts entered into during the fiscal year			250.01
Grand total			45,000.00

700 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

IV. Equipment of Engineer Troops, fiscal year 1902.

1. For purchase of instruments, intrenching tools, etc., for use of the United States Engineer School at Washington Barracks, D. C.:	
July 1, 1902, balance unexpended	\$494.32
June 30, 1903, amount expended during fiscal year	\$372.50
June 30, 1903, amount turned into the Treasury during fiscal year	121.82
	494.32

V. Engineer Equipment of Troops, fiscal year 1903.

From the above appropriation the following allotments were assigned at various times during the fiscal year for disbursement at Washington Barracks, D. C., in accordance with detailed and approved project for expenditure, viz:

1. For engineer equipment—	
July 18, 1902, amount allotted	\$1,000.00
August 4, 1902, amount allotted	4,000.00
Total	5,000.00
June 30, 1903, amount expended during fiscal year	4,936.29
July 1, 1903, balance unexpended	63.71
July 1, 1903, outstanding liabilities	\$63.61
July 1, 1903, amount to be turned into the Treasury	.10
	63.71
2. For field photographic outfit—	
August 4, 1902, amount allotted	1,500.00
June 30, 1903, amount expended during fiscal year	951.27
July 1, 1903, balance unexpended	548.73
July 1, 1903, outstanding liabilities	548.73
3. For purchase of small shovels and pick mattocks—	
May 2, 1903, amount allotted	2,287.19
June 30, 1903, amount expended to end of fiscal year	None.
July 1, 1903, balance unexpended	2,287.19
July 1, 1903, outstanding liabilities	2,287.19

VI. Emergency fund, War Department (act March 3, 1899).

For equipment of electrical laboratory at Engineer School, Washington Barracks:

July 1, 1902, balance unexpended	\$5,950.91
June 30, 1903, amount expended during fiscal year	4,939.99
July 1, 1903, balance unexpended	1,010.92
July 1, 1903, outstanding liabilities	76.41
July 1, 1903, balance available	934.51

VII. Examinations, Surveys, and Contingencies of Rivers and Harbors.

Under date of October 25, 1902, the Chief of Engineers, United States Army, made an allotment of \$500 from the above appropriation, to be applied exclusively to the repair of instruments received at the engineer depot in a slightly damaged condition:

October 25, 1902, amount allotted	\$500.00
June 30, 1903, amount expended during fiscal year	491.40
July 1, 1903, balance unexpended	8.60
July 1, 1903, outstanding liabilities	8.60

NEW APPROPRIATIONS.

I. The following items have been allotted by the Chief of Engineers, United States Army, from appropriations contained in the act of Congress for the support of the Army for the fiscal year ending June 30, 1904, for disbursement at Washington Barracks, D. C.:

1. Engineer Depot, 1904, act March 2, 1903, for incidental expenses of depot (incidentals)	\$8,000.00
2. Engineer Depot, 1904, act March 2, 1903, for purchase and repair of instruments (instruments)	500.00
3. Engineer Equipment of Troops, 1904, act March 2, 1903, for ponton trains, intrenching tools, instruments, drawing materials, etc.	5,400.00
Total	13,900.00

II. The following item has been appropriated for the Engineer School, Washington, D. C., in the act of Congress making appropriations for the support of the Army for the fiscal year ending June 30, 1904, to be disbursed at Washington Barracks, D. C.:

For equipment and maintenance of the Engineer School of Application at Washington Barracks, D. C., including purchase of instruments, machinery, implements, models, and materials for the use of the school and for instruction of engineer troops in their special duties, etc., for purchase and binding of professional books; for extra-duty pay to soldiers employed on work in addition to and not strictly in the line of their military duties; for travel expenses of officers; unforeseen expenses, etc. \$25,000.00

1. Formal contracts in force during the fiscal year.

Name of contractor: The Gas Engine and Power Company and Charles L. Seabury & Co., Consolidated, of New York, N. Y., for constructing at their works and delivering at Washington Barracks, D. C., one small sectional steamboat.

Date of contract: June 15, 1903.

Date of approval: June 25, 1903.

Date of completion: One hundred working days, from date of approval of contract.

Amount of contract, \$18,750.

2. Emergency contracts in force during the fiscal year.

Name of contractor: Oliver Ames & Sons Corporation, of North Easton, Mass., for manufacturing and delivering at Washington, D. C., 140 dozen small-sized shovels.

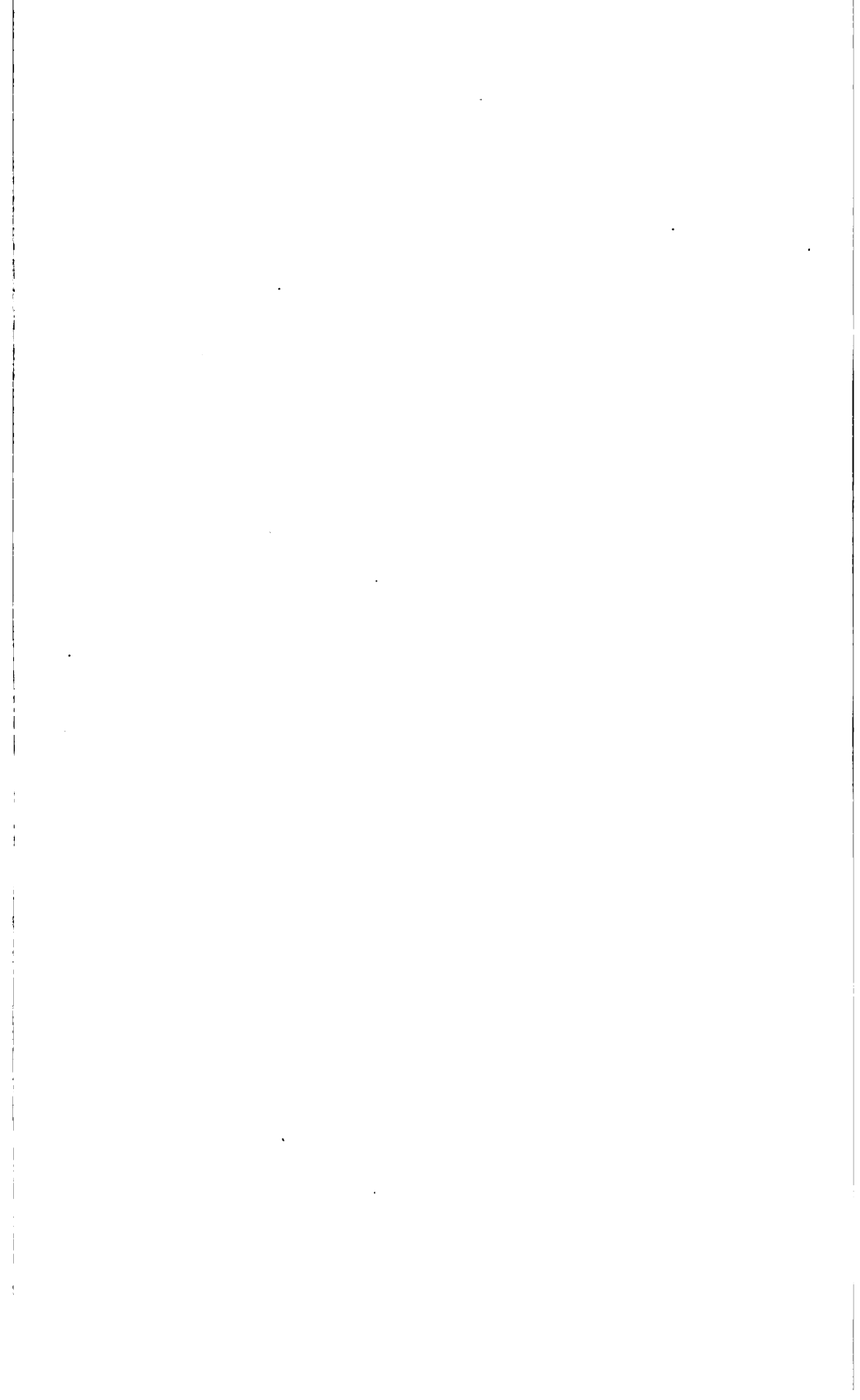
Date of contract: June 4, 1903.

Date of approval: None (emergency contract).

Date of beginning work: June 7, 1903.

Date of completion: No time set; but agreed to complete and deliver all shovels at as early a date as practicable.

Amount of contract: \$1,155.



APPENDIX No. 3.

ENGINEER DEPOT, FORT LEAVENWORTH, KANSAS.

REPORT OF MAJ. SMITH S. LEACH, CORPS OF ENGINEERS, FOR THE
FISCAL YEAR ENDING JUNE 30, 1903.

FORT LEAVENWORTH, KANS.,
September 13, 1903.

GENERAL: I have the honor to transmit herewith annual reports on operations at Fort Leavenworth under general appropriations.

Very respectfully,

SMITH S. LEACH,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

UNITED STATES ENGINEER DEPOT, FORT LEAVENWORTH, KANS.

An allotment of \$2,000 from the appropriation "Engineer Depot, 1903," was made on August 4, 1902, \$650 of which was set aside for the purchase of materials for the repairs to ponton material and the remaining \$1,350 for pay of enlisted men employed on extra duty as carpenters, blacksmiths, and mechanics.

Under the second heading of this allotment there has been expended \$670.51 in payment of extra-duty pay of enlisted men employed in overhauling the ponton material. Authority has been obtained for the detail of nine men from the battalion on such duty. Three of these are occupied with the shoeing of the animals of the battalion.

There have been unavoidable interruptions in the work of the extra-duty men by drills, field service, and maneuvers. Authority was obtained for the use of \$549.80 of the funds allotted for extra-duty pay for the purchase of material, so that the total expenditure for this purpose was \$1,045.47, with which have been purchased brakes for ponton carriages, iron, lumber, and hardware for the repair of the ponton materials. The total expenditure under this appropriation amounts to \$1,715.98, leaving \$284.02 to be returned to the Treasury of the United States.

Under the appropriation "Engineer Equipment of Troops, 1903," the following allotments have been made: On August 19, 1902, \$3,500 to be disposed of as follows: (a) For changing brake mechanism and

draft gear of one division each of light and heavy ponton train, \$750; (b) for purchase of paint, oil, putty, etc., \$500; (c) for purchase of photographic and drafting supplies, \$500; (d) for equipment of Engineer shop for instruction, \$1,750. By subsequent authority this disposition was modified by taking \$500 from (a), \$375 from (b), and \$125 from (c), and devoting the \$1,000 thus obtained to the purchase of tools and supplies for the battalion equipment. Under (a) a complete set of brakes of special design was purchased for the two divisions—one heavy and one light—of the ponton train. These have been applied to the carriages.

Under (b) paint, oils, putty, and brushes for repainting the ponton material have been purchased. Under (c) photographic and drafting supplies have been purchased as required and the following instruments and apparatus: A Premo Long Focus Camera 8 by 10, with No. 7 Goerz lens, Iris shutter and focal-plane shutter for same, a ray filter, a map-printing and lettering device, an Ockerson topographical mapping device, a pair of Lemaire field glasses. Under (d) machinery for the Engineer shop has been purchased, including a Universal wood worker, a band saw, a hand drill, a power drill, a lathe, a grinder head, a grindstone, a blower, and the necessary shafting, belting, and pulleys to install the same.

A stationary engine has been set up in the shop and a boiler in a separate building on account of lack of space. The machinery has not yet been set up.

The allotment of \$1,000 for the purchase of tools and supplies has been used in the purchase of tools and supplies needed for the battalion equipment.

On June 8, 1903, an allotment of \$1,200 was made for the reproduction of the plates in connection with the publication of the Engineer Field Manual. An informal contract has been made with L. L. Poates, of New York, for this work, to be done at a cost of \$360.

The total expenditures out of the appropriations have been \$3,850.03, leaving a balance of \$849.97 to be turned into the Treasury under this appropriation.

APPENDIX No. 4.

ENGINEER DEPOT, NEW YORK CITY.

REPORT OF FIRST LIEUT. EDWARD H. SCHULZ, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1903.

UNITED STATES ENGINEER OFFICE,
ROOM S-7, ARMY BUILDING,
New York City, July 14, 1903.

GENERAL: I have the honor to forward herewith, in duplicate, annual report of the Engineer Depot, New York City, for the fiscal year ending June 30, 1903.

Very respectfully, your obedient servant,

EDWARD H. SCHULZ,
First Lieutenant, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

ENGINEER DEPOT, NEW YORK CITY.

The work of this office during the fiscal year consisted in purchasing engineering supplies of all kinds for the equipment of engineer troops and in the purchase and repair of instruments for use of engineer officers in charge of districts, and department and division engineers.

ENGINEER DEPOT, WILLETS POINT, N. Y.

The Engineer depot at Willets Point, N. Y., was closed on June 30, 1902, and transferred to Army Building, New York City. All property was disposed of by transfer and condemnation. Final returns for the Willets Point depot were rendered December 31, 1902.

SUBMARINE MINING MATERIAL.

Such purchases as were authorized by the Chief of Engineers were made by this office.

In accordance with instructions received from the Chief of Engineers under date of February 21, 1903, the unexpended balance of funds on account of allotments from appropriation for "Torpedoes for Harbor Defense," for purchase of submarine mining material, etc. (\$1,404.06), was deposited to the credit of the appropriation.

TEST OF THE ENGELHARDT COLLAPSIBLE LIFE BOAT.

Under date of December 11, 1902, in compliance with orders from the Department, I witnessed a test of the Engelhardt collapsible life boat at the New York Navy-Yard, and report thereon was submitted to the Chief of Engineers on December 19, 1902.

ISSUE OF SKETCHING CASES FOR TEST.

The manufacture of six Bower sketching cases was completed March 20, 1903, and two issued to each of the three battalions of engineers for test.

The manufacture of six McGregor-Harts sketching boards was completed June 29, 1903, and two issued to each of the three battalions of engineers for test.

REPAIR OF INSTRUMENTS.

Instruments in need of repairs were received at this office and were repaired and issued.^a

* * * * *

Total number of instruments repaired and average cost.

	Total cost.	Average cost.
78 transits	\$3,290.85	\$41.81
53 levels	1,132.15	21.36
15 sextants	439.15	29.21
5 plane tables	104.75	20.95
7 compasses, surveyors'	62.00	8.86
11 compasses, prismatic	40.25	3.66
2 compasses, square	2.00	1.00
1 compass, beam	3.25	3.25
3 gradienters	51.25	17.08
5 current meters	93.50	18.70
2 tide gauges	65.75	32.88
24 level rods	154.75	6.45
3 proportional dividers	10.35	3.45
1 protractor	5.50	5.50
4 boxes drawing instruments	74.75	18.69
3 artificial horizons	21.00	7.00
1 pent. prism range finder	4.75	4.75
1 anemometer	17.50	17.50
4 chronometers	246.30	61.58
4 chains, surveying	18.00	4.50
1 spyglass	7.00	7.00
2 watches	25.25	12.63
6 barometers	35.80	5.98
1 photo shutter	1.00	1.00
	5,875.95	

Supplies to the values stated were issued during the year, as follows:^b

Engineer officer--	
Department of the East	\$291.78
Department of Texas	114.31
Department of the Lakes	171.76
Department of the Missouri	229.27
Department of Dakota	506.07
Department of the Colorado	11.53
Department of California	812.00
Post engineer officers	1,266.79

^a List of instruments repaired not printed.

^b Lists of supplies not printed.

Engineer officers of districts	\$46.20
First Battalion of Engineers	741.18
Third Battalion of Engineers	101.33
Engineer Depot, Washington Barracks, D. C	1,008.60
State militia	46.82
Balance of United States	589.07
Alaska	14.72
Cuba	19.35
Porto Rico	12.00
Philippine Islands (including Second Battalion of Engineers)	3,292.87
China	10.95
Total	9,286.60

Total number of articles shipped and aggregate cost.

17 sets arrows	\$37.26
1 barometer	17.60
4 Batson sketching cases	105.40
12 books, Beach's Manual of Field Engineering	18.60
6 books, Fiebeger's Fortification	9.00
24 books, memorandum	9.15
12 books, sketch	18.45
6 Bower sketching cases	154.00
16 brushes, camel hair	2.50
2 cameras, photographic	190.50
219 cavalry sketching cases	1,160.70
5 chains	34.53
1 bottle Chinese white	2.25
24 dozen clips, spring	4.80
1 roll cloth, blue print	2.32
1 roll cloth, Maduro	4.40
115 rolls cloth, tracing	881.41
1 compass, beam	5.36
132 compasses, military	339.74
78 compasses, prismatic	820.96
102 copies blue and brown prints	13.29
6 dozen covers for compasses of cavalry sketching cases	7.20
48 curves	10.88
2 cyclometers	2.00
14 dividers	16.16
1 drafting machine, Universal	30.55
15 drawing boards	13.52
25 drawing instruments	146.60
36 electric incandescent lamps	7.56
14½ dozen erasers	7.89
1 bottle erasing fluid	.16
2 fascine chokers	9.00
2 glasses for washing brushes	.40
320 bottles india ink	57.19
14 sticks india ink	5.60
8 cans ink, Neostyle	18.00
6 tubes ink	6.00
2 ink cups	.56
4 ink slabs	1.08
48 boxes Kohinoor leads	28.04
6 level vials	13.50
5 boxes Maduro fixing salt	1.68
2 magnifiers, pocket	.83
1 mallet	.35
4 manuals, ponton	4.00
1 map measure	2.88
Material for preservation of torpedoes	106.93
6 McGregor-Harts sketching boards	150.00
19 odometers	155.80
1 oilstone and oil	.84
1 pantograph	76.50
1,030 rolls paper, blueprint	1,698.19

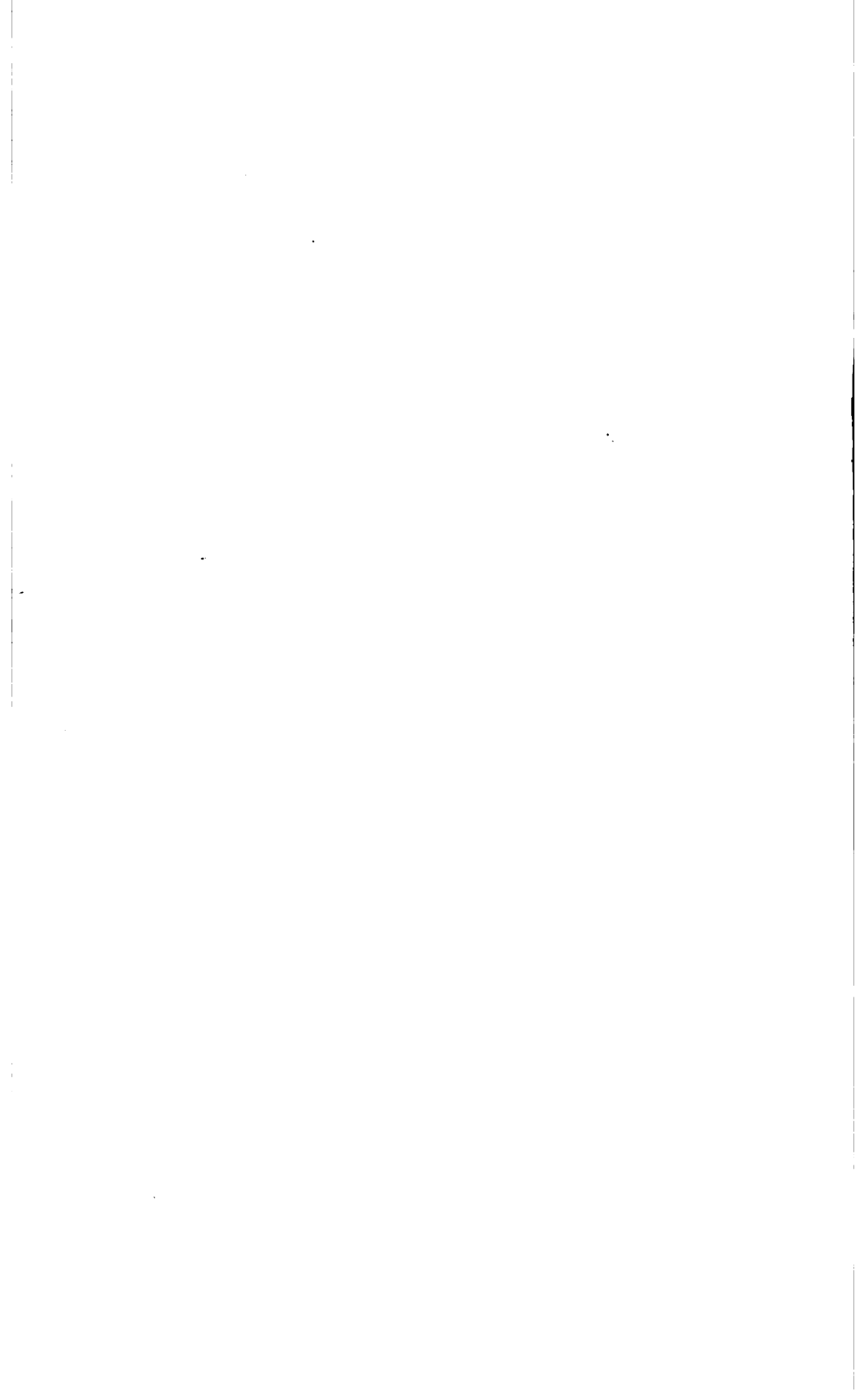
2 rolls paper, cross-section	\$15.60
2 rolls paper, profile	15.60
44 rolls paper, drawing	219.77
58 rolls paper, Maduro	97.90
18 gross paper, portrait	109.02
4 rolls paper, tracing	5.36
10 $\frac{1}{2}$ quires paper, Whatman's	33.24
3 quires paper, drawing	1.50
$\frac{1}{4}$ quire paper, transfer	.40
1 quire paper, sketching	.67
12 paper weights	7.91
1 tube paste	.20
3 pedometers	11.81
299 $\frac{1}{2}$ dozen pencils	222.17
1 dozen pencil holders	.96
4 dozen pencil pointers	3.84
2 $\frac{1}{2}$ dozen penholders	2.40
97 dozen pens (mapping, crow, quill, etc.)	29.27
15 pens, drawing (road, ruling, swivel, bow, etc)	24.06
6 Penta prism range finders	81.60
125 rolls photo films	200.00
90 dozen photo plates	117.78
Photographic supplies	74.12
19 plumb bobs and lines	38.93
32 poles (sighting, ranging, and stadia)	106.72
1 box pounce	.12
4 prints, backed	1.50
28 protractors	60.43
1 psychrometer	1.60
6 dozen rubber bands	.54
7 rulers, parallel	33.05
1 ruler, adjustable, curve	2.30
2 nests saucers, cabinet	.96
110 scales, triangular, boxwood	55.11
1 scale, triangular, metal	2.00
1 scale, apothecaries	6.60
3 scales, white edge	2.25
6 sketching pads	7.20
1 sponge rubber	.35
34 straight edges	49.18
1 switchboard	420.00
6 tack lifters	.96
12 dozen tacks, solid steel	7.68
249 dozen tacks, thumb	58.27
46 tapes	342.60
500 pieces tape	62.50
1 tent, dark, and poles	12.00
4 trestles, adjustable	21.00
1 transit tripod	8.50
123 triangles	96.78
8 T squares	9.00
2 tubes, preserving, for prepared paper	5.00
2 typewriters	218.70
1 stop watch	19.20
2 dozen water colors, half pans	8.84
1 set water colors	4.44
Total	9,286.60

Money statements.

I. Torpedoes for Harbor Defense (act March 1, 1901, for "Purchase of Submarine Mining Materials, etc."):

July 1, 1902, balance unexpended	\$2,075.39
June 30, 1903, amount expended during fiscal year	\$671.33
February 21, 1903, amount deposited to credit of Treasurer United States	1,404.06
	<u>2,075.39</u>

II. Engineer Equipment of Troops, 1903 (act of June 30, 1902):	
June 30, 1903, total of allotments received	\$10,323.05
June 30, 1903, amount expended during fiscal year	10,323.05
III. Engineer Equipment of Troops, 1903 (act June 30, 1902, "Purchase and Repair of Instruments"):	
November 7, 1902, amount allotted	625.00
June 30, 1903, amount expended during fiscal year	625.00
IV. Engineer Depot, 1903:	
1. Act June 30, 1902, for "Instruments"—	
July 10, 1902, amount allotted	2,500.00
June 30, 1903, amount expended during fiscal year	2,500.00
2. For "Incidentals"—	
December 4, 1902, amount allotted	416.69
June 30, 1903, amount expended during fiscal year	416.69
V. Examinations, Surveys, and Contingencies of Rivers and Harbors	
"Purchase and Repair of Instruments:"	
June 30, 1903, total of allotments received	1,750.00
June 30, 1903, amount expended during fiscal year	1,801.98
July 1, 1903, balance available	448.02
VI. Gun and Mortar Batteries (act of June 6, 1902, "Purchase and Repair of Instruments"):	
June 30, 1903, total of allotments received	1,125.00
June 30, 1903, amount expended during fiscal year	616.73
July 1, 1903, balance available	508.27



RIVERS AND HARBORS, ETC.

APPENDIX A.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE EAST OF AND INCLUDING PORTLAND HARBOR.

REPORT OF MAJ. S. W. ROESSLER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Lubec channel, Maine. | 9. Camden Harbor, Maine. |
| 2. Narraguagus River, Maine. | 10. Harbor at Rockland, Maine. |
| 3. Breakwater from Mount Desert to Porcupine Island, Bar Harbor, Maine. | 11. Carvers Harbor, Vinalhaven, Maine. |
| 4. Harbor at Sullivan Falls, Maine. | 12. Georges River, Maine. |
| 5. Union River, Maine. | 13. Kennebec River, Maine. |
| 6. Bagaduce River, Maine. | 14. Portland Harbor, Maine. |
| 7. Penobscot River, Maine. | 15. Removing sunken vessels or craft obstructing or endangering navigation. |
| 8. Harbor at Bucksport, Maine. | |

HARBOR LINES.

16. Across head of Lermonds Cove, Rockland Harbor, Maine.

UNITED STATES ENGINEER OFFICE,
Portland, Me., July 22, 1903.

GENERAL: I have the honor to forward annual report for the fiscal year 1903 for river and harbor works in my charge.

* * * * *

Very respectfully, your obedient servant,

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

A 1.

IMPROVEMENT OF LUBEC CHANNEL, MAINE.

No operations have been carried on during the fiscal year. A contract has been made for dredging the lower portion of the channel. The work will be done during the fiscal year ending June 30, 1904, and the project thereby completed.

Money statement.

July 1, 1902, balance unexpended.....	\$53,516.82
June 30, 1903, amount expended during fiscal year	378.32
July 1, 1903, balance unexpended.....	53,138.50

APPROPRIATIONS.

March 3, 1879.....	\$44,000
June 14, 1880.....	20,000
March 3, 1881.....	45,000
August 2, 1882.....	20,000
July 5, 1884.....	10,000
August 5, 1886.....	10,000
August 11, 1888.....	20,000
August 18, 1894.....	5,000
August 18, 1894, unexpended balance for improving St. Croix River, made available for Lubec channel.....	35,000
June 3, 1896.....	32,000
March 3, 1899.....	25,000
June 13, 1902.....	53,000
Total.....	319,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: Eastern Dredging Company.

Date of contract: October 18, 1902.

Date of approval: November 22, 1902.

Time for commencement: April 29, 1903.

Time for completion: June 29, 1904.

Rate:

Dredging, 24¢ cents per cubic yard.

Removing bowlders, \$5 per ton of 2,000 pounds.

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Bricks.....	2,000
Coal.....	2,200
Fish.....	48,000
Flour and grain.....	9,000
Lead and tin.....	20,000
Lumber.....	12,000
Oil and mustard.....	10,000
Provisions.....	9,000
Salt.....	3,200
Sardines.....	33,000
Total.....	148,400

Arrivals and departures in calendar year 1902.

	To 28.
Steamers, extreme draft 17 feet	420
Sailing vessels, extreme draft 15 feet	170

A 2.

IMPROVEMENT OF NARRAGUAGUS RIVER, MAINE.

No operations beyond inspection have been carried on during the year.

Money statement.

July 1, 1902, balance unexpended	\$416. 19
June 30, 1903, amount expended during fiscal year	60. 00
July 1, 1903, balance unexpended	856. 19

APPROPRIATIONS.

For improvement above Millbridge:	
Act of March 3, 1871	\$12, 000
Act of June 10, 1872	10, 000
	\$22, 000
For improvement below Millbridge:	
Act of August 5, 1886	10, 000
Act of August 11, 1888	10, 000
Act of September 19, 1890	7, 500
Act of July 13, 1892	7, 500
Act of August 18, 1894	5, 000
Act of June 3, 1896	5, 000
Act of March 3, 1899	5, 000
	50, 000
Total	72, 000

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Bricks	125
Fish and clams	500
General merchandise	9, 000
Grain and flour	2, 000
Iron	50
Lime and cement	100
Lumber and cooperage	19, 700
Salt	10
Stone	400
Wood	1, 000
Total	82, 885

Arrivals and departures in calendar year 1902.

Steamers, coastwise, average draft 8½ feet	252
Sailing vessels, average draft 9 feet	300
Vessels built during the year, tonnage 300 tons	1

A 3.

BREAKWATER FROM MOUNT DESERT TO PORCUPINE ISLAND, BAR
HARBOR, MAINE.

No operations beyond inspection have been carried on during the year. It is proposed to expend the additional appropriation recommended in continuing the construction of the breakwater.

Money statement.

July 1, 1902, balance unexpended	\$210.82
July 1, 1903, balance unexpended	210.82
{ Amount (estimated) required for completion of existing project	230,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	50,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 11, 1888	\$50,000	June 3, 1896	\$10,000
September 19, 1890	50,000	March 3, 1899	20,000
July 13, 1892	50,000		
August 18, 1894	10,000	Total	190,000

COMMERCIAL STATISTICS.

No commercial statistics could be obtained.

A 4.

IMPROVEMENT OF HARBOR AT SULLIVAN FALLS, MAINE.

Operations for the fiscal year, under a contract with H. Herbert Sturgis, resulted in the removal to 10 feet at mean low tide of an additional strip 35 feet wide of Ledge C.

About 222 cubic yards of ledge measured in situ were removed under this contract.

Money statement.

July 1, 1902, balance unexpended	\$5,464.69
June 30, 1903, amount expended during fiscal year	92.93
July 1, 1903, balance unexpended	5,371.76
July 1, 1903, outstanding liabilities	5,000.00
July 1, 1903, balance available	371.76
{ Amount (estimated) required for completion of existing project	20,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	10,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1871	\$10,000
June 10, 1872	25,000
June 3, 1898	5,000
March 3, 1899	5,000
June 13, 1902	5,000
Total	50,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: H. Herbert Sturgis.
 Date of contract: October 24, 1902.
 Date of approval: October 30, 1902.
 Time for commencement: December 3, 1902.
 Time for completion: December 2, 1903.
 Rate: \$22.50 per cubic yard for removal of ledge.
 Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Coal	50
General merchandise	500
Granite	35,000
Lumber and wood	1,500
Total	37,050

Arrivals and departures in calendar year, 1902.

Steamers, average 150 tons	12
Sailing vessels, average 225 tons, draft 10 feet or more	340
Sailing vessels, average 75 tons, draft less than 10 feet	46

A 5.

IMPROVEMENT OF UNION RIVER, MAINE.

At the beginning of the fiscal year the blasting of ledge in the Narrows was in progress and a dredge was at work removing hardpan and small boulders. The contract was finished August 21, 1902, the total quantities of work accomplished being as follows:

	Cubic yards.
Dredging in vicinity of Ellsworth, sawmill waste and all material other than compact gravel or hardpan and boulders	202,594
Hardpan and boulders at same locality	7,581
Dredging at mouth of river	75,360
Excavating ledge in Narrows and removing large boulders	7,563

Money statement.

July 1, 1902, balance unexpended	\$38,558.31
June 30, 1903, amount expended during fiscal year	35,659.67
July 1, 1903, balance unexpended	2,898.64

716 . REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

July 11, 1870.....	\$15,000
March 3, 1871.....	15,000
June 3, 1896.....	15,000
March 3, 1899.....	15,000
June 6, 1900.....	115,000
Total	175,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1902.

Name of contractor: Augustus R. Wright.

Date of contract: October 16, 1899.

Date of approval: November 6, 1899.

Time for commencement: April 1, 1900.

Time for completion: In season of 1901. (Waived.)

Rate:

Dredging mill waste, 25 cents per cubic yard.

Dredging hardpan and bowlders, 75 cents per cubic yard.

Excavation of ledge, \$6.40 per cubic yard.

Dredging at mouth of river, 18 cents per cubic yard.

Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Brick	1,300
Cement and lime	200
Coal	2,000
General merchandise	3,000
Hardware and iron	200
Lumber and cooperage	23,323
Oil	150
Wood	3,096
Total	33,169

Arrivals and departures in calendar year 1902.

Vessels arriving and departing, tonnage and draft not known... 235

A 6.

IMPROVEMENT OF BAGADUCE RIVER, MAINE.

No operations beyond inspection have been carried on during the year.

It is proposed to apply the available balance and the additional appropriation recommended in continuing the excavation of the channel at Winslow Island.

The improvement is of doubtful public benefit.

Money statement.

July 1, 1902, balance unexpended	\$3,847.81
June 30, 1903, amount expended during fiscal year	45.00
July 1, 1903, balance unexpended	<u>3,802.81</u>
{ Amount (estimated) required for completion of existing project	18,875.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 11, 1888	\$3,000	March 3, 1899	\$3,000
September 19, 1890	4,000	June 18, 1903	3,000
July 13, 1892	5,000		
August 18, 1894	5,000	Total	<u>28,000</u>
June 8, 1896	5,000		

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Brick	12,500
Coal	3,000
Cod and mackerel lines	450
Cotton	300
Farm produce	300
Fish	300
General merchandise	30,000
Grain	12,000
Granite	1,500
Lumber and cooperage	19,500
Lime and cement	12,000
Phosphate	200
Wood	7,200
Total	<u>99,250</u>

Arrivals and departures in calendar year 1902.

Steamers:	
Coastwise, draft 10 feet or more, 500 to 1,500 tons	100
Coastwise, draft less than 10 feet, 5 to 250 tons	1,600
Sailing vessels:	
Coastwise, draft 10 feet or more, 150 to 400 tons	150
Coastwise, draft less than 10 feet, 5 to 150 tons	500

The foregoing statement includes the business done at Castine at the mouth of the river.

A 7.

IMPROVEMENT OF PENOBSCOT RIVER, MAINE.

The expenditure for the fiscal year ending June 30, 1903, was \$42. The navigability of the dredged area in the Kenduskeag stream is somewhat impaired by a number of large boulders. It is proposed to apply a small sum of the available balance to have these boulders removed. There are about 50 boulders of an approximate aggregate weight of 70 tons.

No operations have been carried on during the fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$8,672.87
June 30, 1903, amount expended during fiscal year	42.00
July 1, 1903, balance unexpended	8,630.87

APPROPRIATIONS.

March 2, 1829 (for survey)	\$300
July 11, 1870, (at Bangor and below)	15,000
March 3, 1871 (at Bangor and below)	50,000
June 10, 1872	40,000
March 3, 1873	20,000
June 23, 1874	20,000
March 3, 1875 (\$10,000 to be expended at or near Bucksport Narrows)	25,000
August 14, 1876 (\$4,000 to be expended at or near Bucksport Narrows)	10,000
June 18, 1878 (\$2,500, or so much thereof as necessary, to be expended at or near Bucksport Narrows)	12,000
March 3, 1879	6,000
July 5, 1884 (for Bangor Harbor and Penobscot River)	20,000
August 5, 1886 (for widening channel at Bangor and removing obstructions near Crosbys Narrows)	15,000
August 11, 1888 (\$20,000 to be expended between Bangor and Crosbys Narrows and \$30,000 between Bucksport and Winterport)	50,000
September 19, 1890 (for continuing improvement and for dredging near Sterns's mill)	25,000
July 13, 1892	40,000
March 3, 1899	28,000
Total	376,300

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Bricks	2,610
Cement and lime	9,606
Coal	325,796
Fertilizer	9,015
General merchandise	33,427
Grain, feed, and flour	8,788
Hay	4,620
Ice	1,382
Iron and steel	1,440
Lumber, wood, and cooperage	208,696
Oil	8,692
Salt	1,747
Sand, clay, and gravel	4,110
Shooks, box	14,040
Spool bars	6,847
Stone and paving	47,324
Sulphur	1,230
Total	689,369

Arrivals and departures in calendar year, 1902.

Steamers:

Foreign, about 1,100 tons	6
Coastwise, tonnage not stated	1,596

Sailing vessels:

Foreign, about 500 tons	56
Coastwise, tonnage not stated	1,694

Vessels built during the year as follows:

1 schooner, 1,038 gross tons.
1 steamer, 149 gross tons.
1 steam yacht, 94 gross tons.

One new line of transportation established during the year between Bangor and Isleboro, Me.

A 8.

IMPROVEMENT OF HARBOR AT BUCKSPORT, MAINE.

The project for improvement at Bucksport Harbor under appropriation of June 13, 1902, is given in detail in the report of the Chief of Engineers.

Dredging operations under contract of October 14, 1902, were commenced April 3, 1903, and during the fiscal year 124,970 cubic yards, scow measurement, were removed. The project is practically completed, only a few more days' work being required to finish it.

(The contract was completed July 7, 1903, and 130,046 cubic yards of material were removed.)

Money statement.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	9,474.42
July 1, 1903, balance unexpended	10,525.58
July 1, 1903, outstanding liabilities	1,060.64
July 1, 1903, balance available	9,464.94
July 1, 1903, amount covered by uncompleted contracts	9,813.69

APPROPRIATIONS.

June 13, 1902	\$20,000
---------------------	----------

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: Morris & Cumings Dredging Company.

Date of contract: October 14, 1902.

Date of approval: November 22, 1902.

Time for commencement: January 29, 1903.

Time for completion: November 29, 1903.

Rate:

Dredging, 12.48 cents per cubic yard.

Removing bowlders, \$4 per ton.

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

No commercial statistics could be obtained.

A 9.

IMPROVEMENT OF CAMDEN HARBOR, MAINE.

Dredging operations under contract of May 4, 1903, were commenced on June 25, 1903, and during the fiscal year 5,781 cubic yards, scow measurement, were removed.

Operations will be continued and the project completed in about two months.

Money statement.

July 1, 1902, balance unexpended.....	\$7,459.21
June 30, 1903, amount expended during fiscal year	44.70
July 1, 1903, balance unexpended.....	7,414.51
July 1, 1903, outstanding liabilities	65.00
July 1, 1903, balance available.....	7,349.51
July 1, 1903, amount covered by uncompleted contracts	6,962.50

APPROPRIATIONS.

March 3, 1873.....	\$10,000	August 17, 1894.....	\$12,000
June 23, 1874.....	10,000	June 3, 1896.....	10,000
March 3, 1875.....	10,000	June 13, 1902.....	7,400
August 11, 1888.....	5,000		
September 19, 1890.....	6,000	Total.....	82,400
July 13, 1892.....	12,000		

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: Hamilton & Sawyer.

Date of contract: May 4, 1903.

Date of approval: May 16, 1903.

Time for commencement: November 16, 1903.

Time for completion: May 14, 1904.

Rate:

Dredging, 26½ cents per cubic yard.

Removing bowlders, \$10 per ton.

COMMERCIAL STATISTICS.

No commercial statistics could be obtained.

A 10.

IMPROVEMENT OF HARBOR AT ROCKLAND, MAINE.

No work was in progress during the fiscal year ending June 30, 1903.

The top course of cap stones was undisturbed the whole length of the breakwater. The sea slope between high and low water is protected by large stones, 4 to 8 tons in weight. A number of these were displaced during the storms of the past winter and should be replaced. It is estimated that about 1,000 tons of rock, more or less, would be required to repair the damage to the slope. Funds in hand are sufficient for this repair work.

Money statement.

July 1, 1902, balance unexpended	\$45,406.59
June 30, 1903, amount expended during fiscal year	10,825.80
July 1, 1903, balance unexpended	34,580.79

APPROPRIATIONS.

June 14, 1880	\$20,000	August 18, 1894	\$30,000
August 2, 1882	40,000	June 3, 1896	25,500
July 5, 1884	40,000	June 4, 1897	350,000
August 5, 1886	22,500	July 1, 1898	300,000
August 11, 1888	30,000		
September 19, 1890	37,500	Total	925,500
July 13, 1892	30,000		

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Brick, cement and sand	3,100
Coal	70,000
Fish, salt, etc	17,500
Grain and flour	15,000
General merchandise	75,000
Hay and straw	1,000
Ice	7,500
Lime	200,000
Lumber and ship timbers	32,000
Oil	725
Sawdust and ashes	2,000
Steel rails and iron castings	2,000
Wood and cooperage	45,000
Total	470,825

Arrivals and departures in calendar year 1902.

	Tons.
Steamers:	
Coastwise, 400 to 1,500 tons each	700
Coastwise, 25 to 400 tons each	2,215
Under 25 tons	330
Sailing vessels:	
Foreign	54
Coastwise	3,250
For refuge	1,460

A II.

IMPROVEMENT OF CARVERS HARBOR, VINALHAVEN, MAINE.

No operations were carried on during the fiscal year.

It is proposed to apply the available funds to continuing the dredging of the harbor in accordance with the project.

To avoid uncovering ledge, the bounding lines of the area to be dredged have been modified. This in connection with the prices obtained have so far reduced the probable cost of the improvement that it is hoped to complete the work with funds in hand.

Money statement.

July 1, 1902, balance unexpended	\$20,788.31
June 30, 1903, amount expended during fiscal year	766.75
July 1, 1903, balance unexpended	20,021.56
July 1, 1903, amount covered by uncompleted contracts	19,295.50
Amount (estimated) required for completion of existing project	19,000.00

APPROPRIATIONS.

June 3, 1896	\$10,000.00
March 3, 1899	15,000.00
June 13, 1902	20,000.00
Total	45,000.00

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: Hamilton & Sawyer.

Date of contract: April 6, 1903.

Date of approval: April 18, 1903.

Time for commencement: May 22, 1903.

Time for completion: December 31, 1903.

Rate:

Dredging, 14½ cents per cubic yards, measured in scow.

Rock excavation, \$563, lump sum.

Removing boulders, \$5 per ton.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
Coal, hay, wood, lumber, and general merchandise	11,500
Fish, salt, ice, and bait	14,700
Stone	51,000
Total	77,200

Arrivals and departures during calendar year 1902.

Sailing vessels:

Foreign, draft 7 to 15 feet, 40 to 200 tons	20
Coastwise, draft 4 to 18 feet, 100 to 400 tons	235
Coastwise, draft 7 to 14 feet, 7 to 200 tons	820

Steamers:

For refuge	550
Boats making about 7,000 trips. draft 4 to 8 feet	115

A 12.

IMPROVEMENT OF GEORGES RIVER, MAINE.

During the fiscal year the project was completed.

The estimated quantity for the project was 106,843 cubic yards situ measurement, or, with an addition of 25 per cent for loosening, it was 133,554 yards scow measurement. The actual total quantity dredged was 133,799½ cubic yards, exclusive of 4,016 cubic yards of redredging.

Money statement.

July 1, 1902, balance unexpended	\$6,212.06
June 30, 1903, amount expended during fiscal year	854.29
July 1, 1903, balance unexpended	5,357.77
July 1, 1903, outstanding liabilities	4,214.80
July 1, 1903, balance available	1,142.97

APPROPRIATIONS.

Act of June 3, 1896	\$10,000
Act of March 3, 1899	10,000
Act of June 13, 1902	6,000
Total	26,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: Hamilton & Sawyer.

Date of contract: October 17, 1902.

Date of approval: November 6, 1902.

Time for commencement: May 10, 1903.

Time for completion: June 20, 1903.

Rate:

Dredging, 20 cents per cubic yard.

Removing bowlders, \$8 per ton.

Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
Cement, general merchandise, etc	2,000
Coal	6,000
Lime	14,000
Lumber and ship timbers	13,000
Wood	10,000
Total	45,000

Arrivals and departures during calendar year 1902.

Sailing vessels:

Coastwise, from 75 to 300 tons and over	150
Barges, 25 to 50 tons and over	40
Steam tugs	10
Vessels built during year 1902	2
Vessels in process of construction, about 2,100 tons	1

A 13.

IMPROVEMENT OF KENNEBEC RIVER, MAINE.

An examination made after the unusually high and prolonged freshet in the spring of 1902 showed that Beef Rock shoal, which had been dredged in 1892 to a depth of 14 feet at mean low tide, had shoaled about 3 feet, giving a depth of about 11 feet at mean low tide, and that a bad shoal had developed in the channel west of Swan Island, abreast of Theobalds Point, giving a depth of about 8 feet at mean low water and obstructing the passage of the steamboats of the Boston and Kennebec River line. The deepening of the channel at these points being urgent, a dredge was hired, without advertising, for excavating the former to the original depth of 14 feet and the latter to a depth of 11 feet at a cost of 26 cents per cubic yard scow measurement. The material excavated was hard, fine sand and gravel. This work was commenced June 17 and completed August 5, 1902, and 23,342 cubic yards of material, scow measurement, were removed from both shoals.

By the act of June 13, 1902, Congress adopted the project suggested in House Document No. 262, Fifty-sixth Congress, first session, which aims to secure a depth of 11 feet at mean low tide between Gardiner and Augusta, at an estimated cost of \$81,000, appropriated \$40,000 for the work, and authorized the pledging under contract of the remainder.

It is proposed to apply a portion of the balance available for general improvement in dredging in the vicinity of Swan Island, and the funds, available and recommended, for the work between Gardiner and Augusta, to the dredging of the projected channel.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$27, 076. 53
June 30, 1903, amount expended during fiscal year	8, 350. 57
July 1, 1903, balance unexpended	18, 725. 96

BETWEEN GARDINER AND AUGUSTA.

July 1, 1902, balance unexpended	\$40, 000. 00
July 1, 1903, balance unexpended	40, 000. 00
{ Amount (estimated) required for completion of existing project.	41, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.	41, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 2, 1827.	\$4, 000	June 23, 1874.	\$12, 000
March 19, 1828.	3, 500	March 3, 1875.	15, 000
April 23, 1830.	5, 000	March 3, 1881.	10, 000
August 30, 1852.	6, 000	August 11, 1888.	75, 000
June 23, 1866.	20, 000	September 19, 1890.	50, 000
March 2, 1867.	30, 000	July 13, 1892.	100, 000
April 10, 1869.	14, 850	August 18, 1894.	50, 000
July 11, 1870.	15, 000	June 3, 1896.	55, 000
March 3, 1871.	15, 000	June 13, 1902.	40, 000
June 10, 1872.	8, 000		
March 3, 1873.	12, 000	Total	540, 350

COMMERCIAL STATISTICS.

Receipts and shipments.

	Tons.
Brick.....	1, 100
Cement.....	1, 580
Coal.....	64, 798
Fertilizer.....	2, 200
General merchandise.....	18, 428
Grain, feed, and hay.....	295
Granite.....	5, 000
Ice.....	250, 000
Lumber.....	66, 519
Pulp and pulp wood.....	6, 878
Sand.....	2, 250
Wood.....	12, 075
Total.....	431, 118

Arrivals and departures during calendar year 1902.

Steamers:	
Coastwise, 1,000 to 1,500 tons.....	600
Coastwise, about 100 tons.....	1, 200
Sailing vessels:	
Foreign, average 500 tons.....	74
Coastwise, average 500 tons.....	3, 000
Tugs plying on the river.....	10
Ferry boats.....	2
Vessels built during the year.....	80

A 14.

IMPROVEMENT OF PORTLAND HARBOR, MAINE.

During the fiscal year ending June 30, 1903, a contract with Morris & Cumings Dredging Company was in force for dredging the harbor, under project of 1896, to a depth of 30 feet at mean low tide. Three dredges were employed, one of which was withdrawn August 23 and another on September 6, 1902. The third dredge completed the work under contract on October 22, 1902.

The quantities removed by the three dredges during the fiscal year are as follows:

287,692 cubic yards, scow measurement, or
257,365 cubic yards, situ measurement.

The excess of scow over situ measurement was 30,327 cubic yards, or $11\frac{7}{8}$ per cent.

Money statement.

July 1, 1902, balance unexpended.....	\$97, 556. 08
June 30, 1903, amount expended during fiscal year.....	83, 776. 28
July 1, 1903, balance unexpended.....	13, 779. 80

APPROPRIATIONS.

July 4, 1836, for breakwater.....	\$10, 000. 00
March 3, 1837, for breakwater.....	25, 000. 00
July 7, 1838, for breakwater.....	26, 866. 00

June 23, 1866, for extending breakwater, but unexpended balance made available for excavating middle ground by joint resolution of June 5, 1868	\$105,111.05
July 11, 1870, for improving harbor	10,000.00
March 3, 1871, for improving harbor	40,000.00
June 10, 1872, for improving Portland Harbor and Back Bay	45,000.00
March 3, 1873, for improving harbor	50,000.00
June 23, 1874, for improving harbor	20,000.00
March 3, 1875, for improving harbor	20,000.00
March 3, 1881, for improving harbor	20,000.00
August 2, 1882, for improving harbor	35,000.00
July 5, 1884, for improving harbor	30,000.00
August 5, 1886, for improving harbor	30,000.00
August 5, 1886, for Back Cove	26,250.00
August 11, 1888, for improving harbor	40,000.00
August 11, 1888, for Back Cove	25,000.00
September 19, 1890, for improving harbor	40,000.00
September 19, 1890, for Back Cove	25,000.00
July 13, 1892, for improving harbor	30,000.00
July 13, 1892, for Back Cove	20,000.00
August 18, 1894, for Back Cove	20,000.00
June 3, 1896	20,000.00
June 4, 1897	350,000.00
July 1, 1898	200,000.00
March 3, 1901	21,000.00
Total	1,283,727.05

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

Name of contractor: Morris & Cumings Dredging Company.

Date of contract: July 13, 1900.

Date of approval: August 13, 1900.

Time for commencement: October 14, 1900.

Time for completion: July 13, 1902. (Waived.)

Rate:

For dredging, exclusive of 29-foot area, 13.85 cents per cubic yard.

For dredging 29-foot area, 16½ cents per cubic yard.

Contract completed.

COMMERCIAL STATISTICS.

Receipts and shipments, 1902.

	Tons.
Apples	9,986
Asbestos	5,000
Barrels	2,868
Brick, clay, earthenware, sand, and stone	77,170
Brimstone	18,515
Cattle on hoof	18,915
Cement, lime, hair, plaster, and fertilizer	39,379
Coal	926,594
Cotton and wool	21,239
Fish, clams, lobsters, and salt	33,069
General merchandise	218,164
Grain, flour, and provisions	580,087
Leather and hides	6,057
Live stock	494
Lumber and cooperage	97,067
Machinery and iron	9,098
Molasses and sugar	41,477

	Tons.
Oil and oilcloth	26,505
Printing paper, paper stock, and rags	55,850
Rope, sisal, and hemp	4,251
Sulphur and saltpeter	26,886
Sardines	2,060
Tin plate	3,340
Total	2,224,091

*Arrivals and departures during calendar year 1902.***Steamers:**

Foreign, draft about 28 feet	91
Foreign, 2,000 tons or over	342
Foreign, less than 2,000 tons	7
Coastwise, draft 20 feet, 2,500 tons	312
Coastwise, 15 to 18 feet, from 1,600 to 2,000 tons	1,182
Coastwise, 12 feet, about 1,300 tons	4,301
Coastwise, 10 feet	285
Coastwise, average draft 6 feet, 75 tons or less	12

Sailing vessels:

Foreign, average 265 tons	429
Coastwise, 700 to 2,400 tons	108
Coastwise, draft 16 feet, 150 to 400 tons	98
Coastwise, draft 6 feet, 75 tons or less	56
Barges	18

Vessels built, 2 schooners of 48 net tons; 1 steam tug of 48 net tons, and 1 sloop of 7 net tons,

A 15.**REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR
ENDANGERING NAVIGATION.**

The fishing schooner *Harriet W. Babson* was wrecked January 18, 1903, on Ram Island, near the entrance to Boothbay Harbor, Maine. A subsequent storm carried the wreck against the bridge leading to the light-house, damaging it and interfering with access to the light, and leaving it in a position that threatened further damage to the bridge and with a possibility of the wreck going into the channel. A large steam lighter and wrecking crew was dispatched to the scene, but on arrival it was found that local wreckers had succeeded in breaking up and removing the wreck. The total expense in connection with this wreck was \$143.27.

A 16.**MODIFICATION OF HARBOR LINE ACROSS THE HEAD OF LERMONDS
COVE, ROCKLAND HARBOR, MAINE.**

ROCKLAND, August 22, 1902.

We, the undersigned owners of the property abutting the existing harbor line across the end of Lermonds Cove, in the city of Rockland, Maine, respectfully petition the honorable Secretary of War that the said harbor line be advanced 25 feet farther out in a northerly direction parallel to the existing line. This project is necessary for the protection and development of our property and has received the

proper and lawful consideration and approval of the city government of Rockland, Me., as shown by the inclosed copy of an instrument^a issued under date of August 18, 1902.

JOHN BIRD COMPANY,
By S. M. BIRD, *President*.
HEIRS OF DAVIS TILLSON,
By W. S. WHITE, *Administrator*.
CATHERINE MCINTIRE.

The honorable SECRETARY OF WAR.
(Through Maj. S. W. Roessler,
Corps of Engineers, U. S. Army, Portland, Me.)

[First indorsement.]

U. S. ENGINEER OFFICE,
Portland, Me., September 9, 1902.

Respectfully forwarded to the Chief of Engineers, U. S. Army, recommended for approval.

The within is a request that the harbor line across the head of Lermonds Cove, Rockland Harbor, Maine, be extended outward a distance of 25 feet. The present harbor line at that point is shown in black and the proposed new harbor line in red, on the tracing^a herewith. The application of petitioners has the approval of the mayor and board of aldermen and municipal officers of the city of Rockland.

In my opinion there is no objection to advancing outward the harbor line at this point. The proposed change having been assented to by the abutting property owners and approved by the municipal officers, as shown by papers accompanying, it is thought that the public hearing usually held in such cases may properly be dispensed with in this instance.

Interested parties have represented to me that they are very desirous of erecting the retaining wall along the new harbor line this fall, if the desired change is authorized, and to that end would request a decision at the earliest practicable date.

S. W. ROESSLER,
Major, Corps of Engineers.

(Through the Division Engineer.)

[Second indorsement.]

ENGINEER OFFICE, NORTHEAST DIVISION,
New York, N. Y., September 10, 1902.

Respectfully forwarded to the Chief of Engineers, U. S. Army, concurring in the recommendation of the district officer.

CHAS. R. SUTER,
Colonel, Corps of Engineers, Division Engineer.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 13, 1902.

Respectfully forwarded to the Secretary of War.

This is an application for modification of the established harbor line across the head of Lermonds Cove, Rockland Harbor, Maine.

The modification desired is an extension of the existing line outward for a distance of 25 feet.

The subject has been under consideration by Major Roessler, the district engineer officer, who recommends that the line be modified as requested, it appearing that such change meets the approbation of interested parties.

The proposed change is indicated in red on the accompanying tracing,^a and approval is recommended. The tracing has been prepared for the signature of the Secretary of War.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fourth indorsement.]

WAR DEPARTMENT, *September 17, 1902.*

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
Acting Secretary of War.

^aNot printed.

APPENDIX B.

IMPROVEMENT OF RIVERS AND HARBORS IN MAINE SOUTH OF
PORTLAND HARBOR, IN VERMONT AND NEW HAMPSHIRE, IN
MASSACHUSETTS NORTH OF LYNN HARBOR, AND IN NEW YORK
ON LAKE CHAMPLAIN.

REPORT OF CAPT. HARRY TAYLOR, CORPS OF ENGINEERS, OFFICER
IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH
OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|--|---------------------------------------|
| 1. Saco River, Maine. | 12. Harbor at Manchester, Massachu- |
| 2. Harbor at Isles of Shoals, Maine. | setts. |
| 3. Cocheco River, New Hampshire. | 13. Harbor at Beverly, Massachusetts. |
| 4. Exeter River, New Hampshire. | 14. Sea wall at Marblehead, Massachu- |
| 5. Harbor of refuge at Little Harbor, | setts. |
| New Hampshire. | 15. Harbor at Burlington, Vermont. |
| 6. Harbor at Newburyport, Massa- | 16. Otter Creek, Vermont. |
| chusetts. | 17. Harbor at Plattsburg, New York. |
| 7. Merrimac River, Massachusetts. | 18. Narrows of Lake Champlain, New |
| 8. Powow River, Massachusetts. | York and Vermont. |
| 9. Harbor of refuge at Sandy Bay, | 19. Removing sunken vessels or craft |
| Cape Ann, Massachusetts. | obstructing or endangering navi- |
| 10. Harbor at Rockport, Massachusetts. | gation. |
| 11. Harbor at Gloucester, Massachu- | |
| setts. | |

SURVEY.

20. Marblehead Harbor, Massachusetts.
-

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 23, 1903.

GENERAL: I have the honor to transmit herewith annual report on
works of river and harbor improvement in my charge for the fiscal
year ending June 30, 1903.

Very respectfully, your obedient servant,

HARRY TAYLOR,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

B 1.

IMPROVEMENT OF SACO RIVER, MAINE.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 54, Annual Report of the Chief of Engineers for 1903.

No operations were in progress during the past two years, and the condition of the improvement is the same as on June 30, 1901.

Money statement.

July 1, 1902, balance unexpended	\$5,241.63
July 1, 1903, balance unexpended	5,241.63
{ Amount (estimated) required for completion of existing project	200,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	70,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—

March 2, 1827, for piers, buoys, and removing obstructions at and near entrance	\$7,000
June 23, 1866, for repairing piers	40,000
March 2, 1867, for improving river	40,000
July 25, 1868, for improving river	20,000
April 10, 1869, for improving river	22,275
July 11, 1870, for improving river	10,000
March 3, 1871, for improving river	15,000
June 10, 1872, for improving river	15,000
July 5, 1884, for breakwater	15,000
August 5, 1886, for breakwater	12,500
August 5, 1886, for improving river	12,500
August 11, 1888, for breakwater	12,500
August 11, 1888, for improving river	10,000
September 19, 1890, for improving river, including breakwater and jetty	65,000
July 13, 1892, for improving river, including breakwater	25,000
August 18, 1894, for improving river, including breakwater	10,000
June 3, 1896, for improving river, including breakwater	10,000
March 3, 1899, for improving river, including breakwater	5,000
Total	346,775

COMMERCIAL STATISTICS, 1902.

	Tons.
Coal	27,019
Bricks	10,400
Wood	563
Gravel	90
Total	38,072

Arrivals and departures.

Sailing vessels with a draft of 7½ to 13½ feet and average tonnage of 246:

Coastwise	131
Foreign	2

B 2.

IMPROVEMENT OF HARBOR AT ISLES OF SHOALS, MAINE.

A description of this work may be found on page 55, Annual Report of the Chief of Engineers for 1903.

The river and harbor act of June 13, 1902, appropriated \$30,000 for the completion of the improvement of this harbor in accordance with report submitted in House Document No. 255, Fifty-sixth Congress, first session. The proposed improvement consists in constructing a breakwater to a height of about 15 feet above mean low tide, on the site of the old breakwater, which has been so beaten down and spread out by the sea that it affords no protection at high water.

The construction of the breakwater was commenced June 10, 1903, and at the close of the fiscal year about 1,095 tons of stone had been placed in the breakwater, completing a section 82 feet in length beginning at Smuttynose Island.

Money statement.

July 1, 1902, balance unexpended	\$30,000.00
June 30, 1903, amount expended during fiscal year	41.55
July 1, 1903, balance unexpended	29,958.45
July 1, 1903, outstanding liabilities	1,221.56
July 1, 1903, balance available	28,736.89
July 1, 1903, amount covered by uncompleted contracts	25,578.43

APPROPRIATIONS.

Act of—	
March 3, 1821	\$2,500.00
May 7, 1822	11,500.00
Total	14,000.00
Carried to surplus fund in 1824	748.39
	13,251.61
June 13, 1902	30,000.00
	43,251.61

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: The Massachusetts Contracting Company, Worcester, Mass.

Nature of work: Construction of breakwater.

Date of contract: March 23, 1903.

Date of approval: April 7, 1903.

Date of commencement: On or before May 1, 1903.

Date of completion: On or before November 1, 1903.

Price: \$1.07 per ton of 2,000 pounds for rubblestone deposited in breakwater.

COMMERCIAL STATISTICS.

Shipments and receipts.

	Tons
Coal	500
Merchandise	105
Fish	200
Lumber	108
Total	913

During the summer months there is a line of steamers making two trips daily between this port and Portsmouth, N. H.

It is reported that about 2,500 schooners and small steamers frequented the harbor during the past year.

B 3.

IMPROVEMENT OF COCHECO RIVER, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 56, Annual Report of the Chief of Engineers for 1903.

During the past fiscal year operations have been in progress under the appropriation made by the act of June 13, 1902, including a small balance remaining in hand from a former appropriation. When work was discontinued at the time the last dredging was done, the channel had been completed for a distance of about 4,000 feet below Dover to full proposed dimensions, except over a small portion in the lower part, where, owing to ledge, the required depth was not made. Dredging was resumed April 26, 1903, under contract with Simon J. Donovan, and during the fiscal year the channel has been extended down river a distance of 2,970 feet, making a total length of completed channel of 6,970 feet. Fourteen thousand eight hundred and forty-six cubic yards of material were removed during the year.

Lamprey River.—The act of June 13, 1902, appropriating \$30,000 for Cocheco River authorized the expenditure of \$10,000 of this amount on Lamprey River. At the time this authority was granted by Congress the channel of Lamprey River, which had been dredged to a depth of 11 feet at mean high water about twenty years earlier, had nearly filled up. The project for the expenditure of funds proposed the restoration of the channel to its original depth. Work was begun April 30, 1903, under contract with Bay State Dredging Company and was completed during the month of May, 1903, when a total of 7,675 cubic yards of material had been removed, restoring the original channel of 11 feet depth at mean high water from the mouth up to Newmarket. The total amount expended on this work out of the appropriation for Cocheco River at the close of the fiscal year was \$7,538.41.

Money statement.

July 1, 1902, balance unexpended	\$36,075.21
June 30, 1903, amount expended during fiscal year	11,931.83
July 1, 1903, balance unexpended	24,143.38
July 1, 1903, outstanding liabilities	6,901.77
July 1, 1903, balance available	17,241.61
July 1, 1903, amount covered by uncompleted contracts	15,400.42
{ Amount (estimated) required for completion of existing project.	62,538.41
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.	40,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1886.....	\$5,000	August 5, 1886.....	\$10,000
March 3, 1887.....	5,000	August 11, 1888.....	9,000
March 3, 1871.....	10,000	September 19, 1890.....	25,000
June 10, 1872.....	10,000	July 13, 1892.....	15,000
March 3, 1873.....	10,000	August 18, 1894.....	15,000
June 23, 1874.....	10,000	June 3, 1896.....	15,000
March 3, 1875.....	25,000	March 3, 1899.....	20,000
August 14, 1876.....	14,000	June 13, 1902.....	30,000
June 18, 1878.....	6,000		
August 2, 1882.....	28,000	Total.....	290,000
July 5, 1884.....	28,000		

CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Dredging in Cocheco River.

Contractor: Simon J. Donovan, Boston, Mass.
 Date of contract: March 31, 1903.
 Date of approval: April 11, 1903.
 Date of commencement: On or before May 1, 1903.
 Date of completion: On or before October 30, 1903.
 Price: 65 cents per cubic yard.

Dredging in Lamprey River.

Contractor: Bay State Dredging Company, Boston, Mass.
 Date of contract: March 28, 1903.
 Date of approval: April 11, 1903.
 Date of commencement: On or before May 1, 1903.
 Date of completion: On or before July 31, 1903.
 Price: 95 cents per cubic yard.

COMMERCIAL STATISTICS, 1902—COCHECO RIVER.

	Tons.
Coal	40,000
Lumber	40,000
Merchandise	41,000
Total	121,000

Arrivals and departures.

Vessels arriving 400

It has been impracticable to obtain commercial statistics for Lamprey River.

B 4.

IMPROVEMENT OF EXETER RIVER, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 57, Annual Report of the Chief of Engineers for 1903.

During the past fiscal year operations have been in progress under contract with Bay State Dredging Company. Work was begun April 2, 1903, at Swamscot bar and continued downstream, completing the

channel to full proposed dimensions down to deep water. The turning basin at Exeter, 110 feet wide by 200 feet long, 11 feet deep at mean high water, was then dredged, thus completing the entire approved project for this improvement. A total of 6,594 cubic yards of material was removed under this contract. Work was finished April 28, 1903.

Money statement.

July 1, 1902, balance unexpended	\$7,096.97
June 30, 1903, amount expended during fiscal year	5,812.28
July 1, 1903, balance unexpended	1,284.69
July 1, 1903, outstanding liabilities	537.41
July 1, 1903, balance available	747.28

APPROPRIATIONS.

Act of—	
June 14, 1880	\$30,000
March 8, 1881	15,000
March 8, 1899	12,000
June 18, 1902	7,000
Total	54,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Bay State Dredging Company, Boston, Mass.

Nature of work: Dredging.

Date of contract: March 28, 1903.

Date of approval: April 11, 1903.

Date of commencement: On or before May 1, 1903.

Date of completion: On or before July 31, 1903.

Price: 81½ cents per cubic yard.

COMMERCIAL STATISTICS, 1902.

	Tons.
Coal	5,100
Fish	150
Wood (cord)	800
Leather (scrap)	400
Total	5,950

Arrivals and departures.

Coastwise	64
-----------------	----

During the year schooners and barges of 50 to 225 tons made about 100 trips up and down the river.

B 5.

HARBOR OF REFUGE AT LITTLE HARBOR, NEW HAMPSHIRE.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 58, Annual Report of the Chief of Engineers for 1903.

At the beginning of the fiscal year both breakwaters had been completed and the anchorage dredged to full projected width and depth, except a cut about 25 feet wide on the south side. During the fiscal year the remaining dredging was done under contract with the Bay State Dredging Company. This work, which was done during the month of June, 1903, completes the project for this harbor. A total of 10,787 cubic yards of material was removed under the contract. The breakwaters which were constructed some years ago have been damaged in places by storms, and it is proposed to apply the balance of the funds in hand toward their repair.

Money statement.

July 1, 1902, balance unexpended	\$13,295.82
June 30, 1903, amount expended during fiscal year	6.25
July 1, 1903, balance unexpended	13,289.57
July 1, 1903, outstanding liabilities	2,836.75
July 1, 1903, balance available	10,452.82

APPROPRIATIONS.

Act of—		Act of—	
August 5, 1886	\$10,000	June 3, 1896	\$10,000
August 11, 1888	20,000	March 3, 1899	12,000
September 19, 1890	40,000	June 13, 1902	13,000
July 13, 1892	30,000		
August 18, 1894	10,000	Total	145,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Bay State Dredging Company, Boston, Mass.

Nature of work: Dredging.

Date of contract: March 28, 1903.

Date of approval: April 11, 1903.

Date of commencement: On or before May 1, 1903.

Date of completion: On or before July 31, 1903.

Price: 25 cents per cubic yard.

COMMERCIAL STATISTICS, 1902.

The prospective benefits to commerce and navigation by the construction of this harbor of refuge are, primarily, increased safety to life and property, there being neither imports nor exports. During the calendar year 1902 the harbor was frequented by 515 vessels, as follows: 193 schooners, 138 steamers, 167 sloops, and 17 barges.

The average tonnage was 150; the average draft, 8 feet.

B 6.

IMPROVEMENT OF NEWBURYPORT HARBOR, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 59, Annual Report of the Chief of Engineers for 1903.

No operations were in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1902. It is proposed to apply the available funds toward the extension of the south jetty and to such repairs as may be necessary to both jetties. The work was advertised January 17, 1903, but the only proposal received was rejected as being too high.

Money statement.

July 1, 1902, balance unexpended.....	\$32,945.63
June 30, 1903, amount expended during fiscal year	192.30
July 1, 1903, balance unexpended.....	32,753.33
{ Amount (estimated) required for completion of existing project.....	234,047.49
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
June 14, 1880	\$50,000	July 13, 1892	\$20,000
March 3, 1881	40,000	August 18, 1894	20,000
August 2, 1882	40,000	June 3, 1896	16,000
July 5, 1884	40,000	March 3, 1899	25,000
August 5, 1886	37,500	June 13, 1902	30,000
August 11, 1888	25,000		
September 19, 1890	25,000	Total	368,500

COMMERCIAL STATISTICS, 1902.

	Tons.
Coal	107,000
Lumber	135
Total	107,135

During the year 1902 there were 123 arrivals of vessels; total tonnage, 80,000. The vessels frequenting this harbor are barges and schooners, with an average draft of 12 feet and an average tonnage of 1,000.

B 7.

IMPROVEMENT OF MERRIMAC RIVER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 60, Annual Report of the Chief of Engineers for 1903.

During the fiscal year work was completed under the contract with R. B. Rodermond, a total of 5,874 cubic yards of material and 5.35 cubic yards of bowlders being removed during the year, making a total of 75,022 cubic yards of material dredged and 7.922 cubic yards of bowlders removed under Mr. Rodermond's contract. A contract for the work to be done under the appropriation made by the act of June 13, 1902, was made with Harries & Letteney Company. Operations under this contract were commenced in October, 1902, and up

to the close of the fiscal year a total of 17,576 cubic yards of material had been removed from the section above Rocks Bridge and 6,290 cubic yards from the section below Rocks Bridge, the removal of these quantities completing the channel to full proposed dimensions for a distance of 3,300 feet.

The channel is now completed for 10,600 feet down river from Haverhill, Mass.

Money statement.

July 1, 1902, balance unexpended.....	\$50,882.71
June 30, 1903, amount expended during fiscal year.....	27,310.10
July 1, 1903, balance unexpended.....	23,572.61
July 1, 1903, outstanding liabilities.....	8,608.88
July 1, 1903, balance available.....	14,963.73
July 1, 1903, amount covered by uncompleted contracts.....	8,941.75
(Amount (estimated) required for completion of existing project.....	91,442.70
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	91,442.70
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
May 23, 1828.....	\$32,100.00	March 3, 1879.....	\$5,000.00
April 2, 1830.....	3,506.72	June 14, 1880.....	12,000.00
March 2, 1831.....	16,000.00	March 3, 1881.....	9,000.00
March 2, 1833.....	4,900.00	August 2, 1882.....	9,000.00
June 28, 1834.....	3,860.00	July 5, 1884.....	3,500.00
July 11, 1870.....	25,000.00	September 19, 1890.....	10,000.00
March 3, 1871.....	25,000.00	July 13, 1892.....	1,500.00
June 10, 1872.....	25,000.00	June 3, 1896.....	5,000.00
March 3, 1873.....	25,000.00	March 3, 1899.....	40,000.00
June 23, 1874.....	10,000.00	June 13, 1902.....	40,000.00
March 3, 1875.....	12,000.00		
June 18, 1878.....	10,000.00	Total.....	327,366.72

CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: R. B. Rodermond, New York, N. Y.

Nature of work: Dredging.

Date of contract: September 15, 1900.

Date of approval: October 9, 1900.

Date of commencement: Twenty-one days after date of notification of approval of contract.

Date of completion: November 15, 1901 (not completed until July 25, 1902).

Price per cubic yard:

For dredging, scow measurement, \$0.495.

For removing boulders exceeding 3 tons in weight, \$10.

Contractor: Harries & Letteney Company, Boston, Mass.

Nature of work: Dredging.

Date of contract: September 16, 1902.

Date of approval: November 3, 1902.

Date of commencement: Within ten days after date of notification of approval of contract.

Date of completion: On or before December 1, 1903.

Price per cubic yard:

In section above Rocks Bridge, 55 cents.

In section below Rocks Bridge, \$1.75.

COMMERCIAL STATISTICS, 1902.

The commerce involved in this improvement consists of supplies of coal, lumber, etc., for the cities and towns along its banks; the amount of coal reported in 1902 being 29,901 tons. The greater part of the coal is taken up in flat-bottomed scows.

B 8.

IMPROVEMENT OF POWOW RIVER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 61, Annual Report of the Chief of Engineers for 1903.

No operations were in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1902.

Money statement.

July 1, 1902, balance unexpended.....	\$59.28
July 1, 1903, balance unexpended.....	59.28
{ Amount (estimated) required for completion of existing project.....	49,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	49,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
August 11, 1888.....	\$3,000	June 3, 1896.....	\$12,000
September 19, 1890.....	5,000	March 3, 1899.....	12,000
July 13, 1892.....	4,000		
August 18, 1894.....	15,000	Total.....	51,000

B 9.

IMPROVEMENT OF HARBOR OF REFUGE AT SANDY BAY, CAPE ANN, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 62, Annual Report of the Chief of Engineers for 1903.

During the past fiscal year operations under the appropriation of \$250,000 made by the river and harbor act of March 3, 1899, were completed, and work under the appropriation of \$200,000, made by the river and harbor act of June 13, 1902, was begun. A project for the expenditure of this appropriation in continuing construction of the substructure was approved October 15, 1902.

On June 30, 1902, the substructure of the southern arm was practically completed to mean low water, except for a distance of 70 feet, over which no work had been done, and about 400 feet of the substructure of the western arm had been built to elevation (-12), surmounted by a core of the superstructure, 12 feet wide on top, built up to mean high water. For a farther distance of 1,350 feet the sub-

structure had been built to from 22 to 25 feet below mean low water, about 40 feet wide on top.

During the past fiscal year a total of 137,682 tons of rubblestone was placed in the breakwater. Of this quantity, 45,783 tons were deposited in the southern arm in places where it had not been built out to full projected section and to raise low places where the sub-structure had been beaten down by the sea. The greater part of the stone placed during the year, however, was applied to the extension of the western arm, which was raised to elevation (—12) for a distance of 875 feet from the angle at Abners ledge, and a core of the super-structure was built upon this 875-foot section, up to mean high water, 12 feet wide on top, a distance of about 400 feet, and up to mean low water, 30 feet wide on top, a distance of about 475 feet.

* * * * *

Money statement.

July 1, 1902, balance unexpended	\$277,503.17
June 30, 1903, amount expended during fiscal year	103,801.21
July 1, 1903, balance unexpended	173,701.96
July 1, 1903, outstanding liabilities	8,997.88
July 1, 1903, balance available	164,704.08
July 1, 1903, amount covered by uncompleted contracts	155,278.87
{ Amount (estimated) required for completion of existing project ...	4,541,832.70
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance unexpended July 1, 1903	500,000.00
{ Submitted in compliance with requirements of sundry civil act of	
June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 5, 1884	\$100,000	June 3, 1896	\$150,000
August 5, 1886	100,000	March 3, 1899	250,000
August 11, 1888	100,000	June 13, 1902	200,000
September 19, 1890	150,000		
July 13, 1892	150,000	Total	1,350,000
August 18, 1894	150,000		

CONTRACTS IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Rockport, Pigeon Hill, and Cape Ann Granite companies, Rockport, Mass.

Nature of work: Construction of breakwater.

Date of contract: May 31, 1901.

Date of approval: June 14, 1901.

Date of commencement: July 1, 1901.

Date of completion: September 30, 1902. (Not completed until February 27, 1903.)

Price: \$0.607 per ton of 2,000 pounds for rubblestone delivered in breakwater.

Contractor: Rockport and Pigeon Hill Granite companies, Rockport, Mass.

Nature of work: Construction of breakwater.

Date of contract: February 28, 1903.

Date of approval: March 16, 1903.

Date of commencement: On or before May 1, 1903.

Date of completion: On or before June 30, 1905.

Price: 73 cents per ton of 2,000 pounds for rubblestone delivered in breakwater.

COMMERCIAL STATISTICS.

The entire commerce of New England is directly interested in this improvement. Large shipments of stone are made from several little ports in the vicinity of Sandy Bay, and fish and supplies of coal, etc., are received at these ports, the total amounting annually to between 300,000 and 500,000 tons. While this shipping would be benefited by the harbor, these local statistics have no value as measuring the importance of the improvement.

REPORT OF A BOARD OF ENGINEERS UPON THE FEASIBILITY AND
ADVISABILITY OF CONTINUING TO COMPLETION THE ADOPTED PROJECT
FOR IMPROVING HARBOR OF REFUGE AT SANDY BAY, CAPE
ANN, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., September 18, 1902.

GENERAL: The Board of Engineers constituted by paragraph 2, Special Orders, No. 19, Headquarters Corps of Engineers, July 5, 1902, has the honor to submit the following report:

The duty assigned to the Board was the examination into the project for a breakwater at Sandy Bay, Cape Ann, Massachusetts, required by the river and harbor act approved June 13, 1902, before any expenditure should be made out of the appropriation contained in said act for this work.

As understood by the Board, the questions to be considered are, first, the feasibility; second, the advisability of continuing the project to completion; third, "whether with advantage any part of said original project can be completed, and if so, what part;" and, fourth, "whether any modification can be made therein with a view to diminishing the cost."

The project is understood to be that published in House Document No. 453, Fifty-sixth Congress, first session, in which the estimated cost for the completed work is \$5,891,832.70.

After a consideration of the questions submitted to it the Board is of the opinion—

First, that the project presents no insuperable difficulties of construction, and is therefore entirely feasible.

Second, that all arguments heretofore advanced in support of the improvement can be repeated with emphasis at this time, in view of the steady growth of coastwise trade during the past few years. For this and the further reason that the size and draft of vessels are steadily increasing to a point where many of them can no longer seek refuge in the smaller harbors along the coast heretofore used by smaller craft, the continuation of the improvement is deemed advisable.

Third, that no modification can be made in the project with a view to diminishing the cost.

Fourth, that no portion of it can be left off.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers, Senior Member.

W. S. STANTON,
Lieut.-Col., Corps of Engineers.

S. W. ROESSLER,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

B 10.

IMPROVEMENT OF HARBOR AT ROCKPORT, MASSACHUSETTS.

The location and a detailed description of this harbor may be found on page 64, Annual Report of the Chief of Engineers for 1903.

* * * * *

Work under the approved project was commenced April 9, 1903. On June 30, 1903, 1,332 tons of rubblestone had been placed in the Bearskin Neck breakwater, which was completed for a distance of 160 feet. Nothing in the way of construction had been done on the Norwoods Head breakwater. The contractors had delivered 2,158 tons of stone on the work in addition to the 1,332 tons placed in the Bearskin Neck breakwater.

Money statement.

July 1, 1902, balance unexpended.....	\$22,000.00
June 30, 1903, amount expended during fiscal year.....	1,318.67
July 1, 1903, balance unexpended.....	20,681.33
July 1, 1903, outstanding liabilities.....	1,763.37
July 1, 1903, balance available.....	18,917.96
July 1, 1903, amount covered by uncompleted contracts.....	17,443.04

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836.....	\$10,000.00	March 3, 1847.....	\$645.80
March 3, 1837.....	20,000.00	June 13, 1902.....	22,000.00
July 7, 1838.....	20,000.00		
February 13, 1845.....	18,437.27	Total.....	91,082.57

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Rockport and Pigeon Hill Granite Companies, Rockport, Mass.

Nature of work: Construction of breakwaters.

Date of contract: February 28, 1903.

Date of approval: March 16, 1903.

Date of commencement: On or before May 1, 1903.

Date of completion: On or before September 30, 1903.

Price per ton of 2,000 pounds, rubblestone in both breakwaters, \$1.53; shifting rubblestone in present main breakwater, 50 cents.

COMMERCIAL STATISTICS.

Arrivals and departures.

Eight hundred vessels, mostly fishermen, with an average tonnage of 25 and average draft of 8 feet.

Receipts and shipments.

	Tons.
Coal.....	800
Fish.....	1,231
Oil.....	60
Total.....	2,091

B II.

IMPROVEMENT OF HARBOR AT GLOUCESTER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 65, Annual Report of the Chief of Engineers for 1903.

Work during the past fiscal year was begun May 19, 1903, under contract with Rockport Granite Company and Pigeon Hill Granite Company. Two thousand three hundred and sixty-four tons of dimension stone and 1,743 tons of rubblestone were placed in the superstructure, completing it in part section for a distance of 206 feet beyond the 277 feet completed under a former contract. No work was done on the substructure during the year.

Money statement.

July 1, 1902, balance unexpended	\$78,128.30
Amount appropriated by sundry civil act approved March 3, 1903	60,000.00
	138,128.20
June 30, 1903, amount expended during fiscal year	2,148.25
July 1, 1903, balance unexpended	135,979.95
July 1, 1903, outstanding liabilities	11,963.31
July 1, 1903, balance available	124,016.64
July 1, 1903, amount covered by uncompleted contracts	259,150.09
{ Amount (estimated) required for completion of existing project	167,083.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	167,083.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
June 10, 1872	\$10,000	June 3, 1896	\$34,000
August 5, 1886	5,000	March 3, 1899	40,000
August 11, 1888	10,000	June 13, 1902	75,000
September 19, 1890	15,000	March 3, 1903	60,000
July 13, 1892	40,000		
August 18, 1894	40,000	Total	329,000

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Rockport and Pigeon Hill Granite Companies, Rockport, Mass.

Nature of work: Construction of breakwater.

Date of contract: February 28, 1903.

Date of approval: March 17, 1903.

Date of commencement: On or before May 1, 1903.

Date of completion: On or before September 30, 1906.

Price:

Rubblestone in substructure and in the apron, \$1.07 per ton of 2,000 pounds.

Dimension stone in superstructure, \$4.80 per ton of 2,000 pounds.

Rubblestone in interior of superstructure, \$1.97 per ton of 2,000 pounds.

Galvanized steel cramps in place, 15 cents per pound.

COMMERCIAL STATISTICS.

The accompanying commercial statistics have been furnished by the collector of customs at Gloucester, Mass.:

Amount of revenue collected.

1902 \$4,208

Shipping.

	1902.	
	Number.	Tons.
Entrances:		
Foreign	124	21,500
Domestic	25	1,700
Clearances:		
Foreign	111	12,400
Domestic	30	11,300

Receipts and shipments, 1902.

	Tons.
Coal	54,966
Salt	29,275
Lumber	8,455
Fish (fresh and salt)	65,000
Merchandise	6,331
Miscellaneous	70,000
Brick, lime, and cement	2,916
Iron and steel	12,193
Oil	5,000
Ice	29,000
Wood	2,600
Total	285,736

During the calendar year 1902 8,000 vessels were boarded by the United States revenue officials. About 60,000 passengers were carried to and from Gloucester by steamer. Forty-eight schooners, 7 sloops, and 7 steamers, average tonnage about 82, were built in the vicinity during the year.

B 12.

IMPROVEMENT OF HARBOR AT MANCHESTER, MASSACHUSETTS.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 67, Annual Report of the Chief of Engineers for 1903.

No operations have been in progress during the past fiscal year, and the condition of the improvement is the same as on June 30, 1902.

The river and harbor act approved June 13, 1902, appropriated \$5,000 for the continuation of the dredging of this harbor. A project for the expenditure of this appropriation was approved July 29, 1902, and contract was entered into with Charles H. Souther, of Boston, Mass., under date of May 11, 1903. The work is to be done during the present season under this contract upon completion by the same contractor of dredging in Beverly Harbor, Massachusetts.

Money statement.

July 1, 1902, balance unexpended	\$5,252.22
June 30, 1903, amount expended during fiscal year	105.55
July 1, 1903, balance unexpended	5,146.67
July 1, 1903, outstanding liabilities	55.63
July 1, 1903, balance available	5,091.04
July 1, 1903, amount covered by uncompleted contracts	4,500.00
{ Amount (estimated) required for completion of existing project	15,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
August 11, 1888	\$2,500	June 13, 1902	\$5,000
September 19, 1890	5,000		
July 13, 1892	6,800	Total	24,300
March 3, 1899	5,000		

The first three appropriations were expended in execution of the project of November 28, 1887.

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Charles H. Souther, Boston, Mass.
 Nature of work: Dredging.
 Date of contract: May 11, 1903.
 Date of approval: May 21, 1903.
 Date of commencement: On or before May 15, 1903.
 Date of completion: On or before September 15, 1903.
 Price: 38½ cents per cubic yard.

COMMERCIAL STATISTICS, 1902.

	Tons.
Coal	2,000
Lumber	100
Miscellaneous	1,500
Total	3,600

A daily average of five yachts, small coasting and fishing vessels, frequent the harbor during seven months in the year.

B 13.

IMPROVEMENT OF BEVERLY HARBOR, MASSACHUSETTS.

The location and a detailed description of this harbor may be found on page 68, Annual Report of the Chief of Engineers for 1903.

This is a new work. * * *

* * * A project for the expenditure of \$10,000 available for this work was approved August 1, 1902. Contract for dredging was entered into under date of May 11, 1903, with Charles H. Souther, of Boston, Mass. Work will be commenced in the early part of July, 1903.

Money statement.

July 1, 1902, balance unexpended	\$10,000.00
June 30, 1903, amount expended during fiscal year	99.31
July 1, 1903, balance unexpended	9,900.69
July 1, 1903, outstanding liabilities	94.53
July 1, 1903, balance available	9,806.16
July 1, 1903, amount covered by uncompleted contracts	6,075.00

APPROPRIATION.

Act of June 13, 1902	\$10,000.00
----------------------------	-------------

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Charles H. Souther, Boston, Mass.
 Nature of work: Dredging.
 Date of contract: May 11, 1903.
 Date of approval: May 21, 1903.
 Date of commencement: On or before May 15, 1903.
 Date of completion: On or before September 15, 1903.
 Price: 33½ cents per cubic yard.

COMMERCIAL STATISTICS, 1902.

Receipts and shipments.

	Tons.
Coal	44,699
Cement	200
Lime	345
Sand	690
Lumber	4,800
Oil	2,041
Salt	31
Fish	62
Iron pipe	100
Firewood	174
Total	58,142

During the year 149 vessels arrived and 149 departed, the average tonnage being 281 and the average draft 14 feet. About 7 per cent of the vessels which enter Salem and Beverly harbors land their cargoes at Salem and Danversport by way of Beverly Harbor. One gasoline propeller was built during the year.

B 14.

REPAIR OF SEA WALL AT MARBLEHEAD, MASSACHUSETTS.

A description of this work may be found on page 68, Annual Report of the Chief of Engineers for 1903.

Nothing has been done and no funds expended during the past fiscal year.

The river and harbor act of June 13, 1902, contains the following provision in regard to this work:

The Secretary of War is hereby authorized and directed to cause a survey and an estimate of cost to be made of a breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck, with a view to protecting the said causeway, which forms one boundary of Marblehead Harbor, from destruction or injury by the sea, and to report to Congress the said estimate; and so much of the one thousand dollars as was appropriated for the repair of the sea wall at Marblehead in the act of March third, eighteen hundred and ninety-nine, as is unexpended and may be necessary, is hereby made available for the purposes of said survey and estimate.

This survey and estimate have been made and report thereon is submitted herewith as Appendix B 20.

Money statement.

July 1, 1902, balance unexpended	\$991.67
July 1, 1903, balance unexpended	991.67

APPROPRIATION.

Act of March 3, 1899	\$1,000.00
----------------------------	------------

B 15.

IMPROVEMENT OF HARBOR AT BURLINGTON, VERMONT.

The approved project and the report of progress of the work to June 30, 1903, may be found on page 69, Annual Report of the Chief of Engineers for 1903.

The river and harbor act of June 13, 1902, appropriated \$57,750 for the repair and maintenance of the breakwater, which it is proposed to apply to continuing the repair work and the replacement of the decayed superstructure with one of concrete. The project for the expenditure of the funds in this manner was approved July 25, 1902, and contract for the work was entered into with John Cashman, of Quincy, Mass., under date of March 30, 1903. The contractor has constructed a derrick scow for use on the work, and made all necessary preparations for carrying the work forward rapidly as soon as the water in the lake subsides sufficiently to permit construction work on the breakwater.

Money statement.

July 1, 1902, balance unexpended	\$58,087.94
June 30, 1903, amount expended during fiscal year	76.63
July 1, 1903, balance unexpended	58,011.31
July 1, 1903, outstanding liabilities	181.99
July 1, 1903, balance available	57,829.32
July 1, 1903, amount covered by uncompleted contracts	54,103.00
{ Amount (estimated) required for completion of existing project	161,855.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	40,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	\$10,000.00	June 18, 1878	\$20,000.00
March 3, 1837	10,000.00	March 3, 1879	15,000.00
July 7, 1838	50,000.00	June 14, 1880	10,000.00
June 11, 1844	10,000.00	March 3, 1881	10,000.00
August 30, 1852	10,000.00	August 2, 1882	12,000.00
May 19, 1864	308.00	July 5, 1884	50,000.00
June 23, 1864	13,500.00	August 5, 1886	18,750.00
June 23, 1866	27,672.20	August 11, 1888	35,000.00
March 2, 1867	86,000.00	September 19, 1890	20,000.00
July 11, 1870	25,000.00	August 18, 1894	10,000.00
March 3, 1871	30,000.00	June 3, 1896	10,000.00
June 10, 1872	30,000.00	March 3, 1899	15,000.00
March 3, 1873	25,000.00	June 6, 1900	^a 5,000.00
June 23, 1874	25,000.00	June 13, 1902	57,750.00
March 3, 1875	25,000.00		
August 14, 1876	20,000.00	Total	679,980.20

NOTE.—In 1872 \$6,669.13 was carried to surplus fund and not expended.

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: John Cashman, Quincy, Mass.

Nature of work: Repair of breakwater.

Date of contract: March 30, 1903.

Date of approval: April 15, 1903.

Date of commencement: On or before June 1, 1903.

Date of completion: On or before November 30, 1905.

Price:

Removing old superstructure, \$7 per linear foot.

Concrete in place in parapet, \$8 per cubic yard.

Concrete in footing blocks, \$9 per cubic yard.

Concrete in decking, \$7 per cubic yard.

Concrete in bags, \$10 per cubic yard.

Stone blocks in coping of deck and under footing blocks on lake side, \$10 per cubic yard.

Riprap stone, \$7 per cord.

Timber and plank, \$40 per 1,000 feet B. M.

Tie rods, 1½ inches by 16 feet, \$7 each.

Tie rods, 1½ inches by 10 feet, furnished by the United States, \$4 each.

Tie rods, 1½ inches by 10 feet, furnished by the contractor, \$6 each.

Use of plant, \$4 per hour.

COMMERCIAL STATISTICS.

Vessels employed in trade.

Class.	Number.	Registered tonnage.	Trips made.
Steam	58	15 to 1,150	1,580
Sail	56	42 to 100	208
Canal boats and barges	323	60 to 162	352

Greatest length, 147 feet; greatest draft, 7½ feet.

^a Allotment from emergency river and harbor act for repair work.

Freight handled.

Articles.	1899.	1900.	1901.	1902.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	30,236	76,762	55,965	32,379
Lumber and timber	23,394	21,008	19,128	41,691
Stone, gravel, and sand	8,249	11,298	14,645	7,790
General merchandise	16,811	22,163	18,476	20,965
Total	87,630	131,226	108,234	102,825

Passengers carried, 122,757.

B 16.**IMPROVEMENT OF OTTER CREEK, VERMONT.**

The approved project and the report of progress of the work to June 30, 1903, may be found on page 71, Annual Report of the Chief of Engineers for 1903.

There were no operations in progress during the past fiscal year, and at the date of this report the condition of the improvement was the same as on June 30, 1902.

Money statement.

{ Amount (estimated) required for completion of existing project.	\$11,248.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
June 10, 1872	\$10,000	September 19, 1890	\$5,000
March 3, 1875	5,000	July 13, 1892	10,000
June 18, 1878	8,000	August 18, 1894	5,000
March 3, 1879	5,000	June 3, 1896	5,000
June 14, 1880	2,000	March 3, 1899	1,000
March 3, 1881	2,000		
August 2, 1882	2,000	Total	62,500
August 11, 1888	2,500		

COMMERCIAL STATISTICS.*Vessels engaged in trade.*

Class.	Number.		Tonnage.	Draft.
	1901.	1902.		
Steam	2	2	18 to 240	<i>Fed.</i> 5 to 8
Canal boats and barges	40	1	142 to 150	5 to 7

Freight handled.

Articles.	1899.	1900.	1901.	1902.
	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>	<i>Tons.</i>
Coal	4,700	5,470	4,500	1,500
Lumber	800	600	560	480
Iron	900	1,000	300	400
Kaolin	500	520	300	900
General merchandise	500	500	100	100
Total	7,200	8,080	5,760	2,780

Number of passengers carried during calendar year ending December 31, 1902, 2,211.

B 17.

IMPROVEMENT OF HARBOR AT PLATTSBURG, NEW YORK.

The report of progress on the work of this harbor to June 30, 1903, may be found on page 72, Annual Report of the Chief of Engineers for 1903.

* * * * *

The project for the expenditure of available funds was approved July 25, 1902. It proposes to use so much as may be necessary for repairing the breakwater and the balance toward restoring the depth in the harbor to its original condition.

The dredging was advertised during the fiscal year, but the proposals received were rejected. The work has been readvertised, and if satisfactory proposals are received it will be completed during the present season. The necessary repairs on the breakwater will also be completed during the coming fall.

Money statement.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	258.16
July 1, 1903, balance unexpended	4,741.84

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836	\$10,000.00	March 3, 1873	\$10,000.00
March 3, 1837	10,000.00	June 23, 1874	5,000.00
July 7, 1838	27,500.00	March 3, 1879	2,000.00
March 3, 1843	2,680.01	June 14, 1880	1,000.00
June 11, 1844	10,000.00	August 5, 1886	5,000.00
May 19, 1864 (allotment)	2,000.00	August 11, 1888	7,000.00
March 3, 1867	26,000.00	September 19, 1890	^a 32,500.00
July 11, 1870	10,000.00	June 13, 1902	5,000.00
March 3, 1871	15,000.00		
June 10, 1872	10,000.00	Total	190,680.01

^a\$239.25 returned to Treasury.

COMMERCIAL STATISTICS, 1902.

Shipments and receipts.

	Tons.
Potatoes.....	1,550
Coal.....	11,000
Lumber.....	675
Iron.....	500
Pulp wood.....	1,000
Hay.....	600
General merchandise.....	225,900
Total.....	241,225

There are four passenger steamers making daily trips to this port. Passengers arriving, 112,500; passengers departing, 112,500.

Canal boats of an average tonnage of 100, tugs of an average tonnage of 70, and passenger steamers from 250 to 1,200 tons, frequent the harbor.

B 18.

IMPROVEMENT OF NARROWS OF LAKE CHAMPLAIN, NEW YORK
AND VERMONT.

* * * * * *

The approved project and the report of progress of the work to June 30, 1903, may be found on page 72, Annual Report of the Chief of Engineers for 1903.

The river and harbor act of June 13, 1902, appropriated \$17,500 for this work, which will be applied to the completion of the improvement. The project for the expenditure of these funds was submitted July 19, and approved July 23, 1902. The dredging to be done was advertised during the year, but all proposals received were rejected and the work readvertised. If satisfactory proposals are submitted under the readvertisement, it is expected that the dredging will be completed during the coming season.

Money statement.

July 1, 1902, balance unexpended.....	\$17,500.00
June 30, 1903, amount expended during fiscal year.....	351.87
July 1, 1903, balance unexpended.....	17,148.13

APPROPRIATIONS.

Act of—		Act of—	
August 5, 1886.....	\$30,000	June 6, 1900.....	a \$1,500
August 11, 1888.....	15,000	June 13, 1902.....	17,500
July 13, 1892.....	18,500		
March 3, 1899.....	5,000	Total.....	87,500

a Allotment from emergency river and harbor act.

COMMERCIAL STATISTICS.

Amount of freight passing through the Narrows of Lake Champlain, 1902.

	Tons.
Timber and lumber	5,700
Pulp, wood	152,970
Salt	1,435
Sugar and molasses	1,335
Coal	88,000
Stone, lime, and clay	29,435
Iron ore	107,935
General merchandise	10,424
Total	395,234
Number of boats passing through the Narrows	4,580

B 19.REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR
ENDANGERING NAVIGATION.

During the fiscal year eight wrecks were removed from Lake Champlain at various points between Whitehall, N. Y., and Larabee Landing, Vermont. All of the wrecks were old canal boats or parts of same which had been sunken and abandoned at various times. A contract for the removal of the eight wrecks was made with Nathaniel E. Gordon, and the wrecks were removed during November and December, 1902, at a total cost of \$3,600.

CONTRACT IN FORCE DURING FISCAL YEAR ENDING JUNE 30, 1903.

Contractor: Nathaniel E. Gordon, Portland, Me.

Nature of work: Removal of eight wrecks in Lake Champlain.

Date of contract: November 14, 1902.

Date of commencement: Within ten days after date of signature of contract.

Date of completion: On or before December 31, 1902.

Price: \$3,347 for the lot.

B 20.

SURVEY OF MARBLEHEAD HARBOR, MASSACHUSETTS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., August 11, 1903.

GENERAL: I have the honor to submit the following report of a survey at Marblehead Harbor, Massachusetts, made in compliance with the following proviso in the river and harbor act approved June 13, 1902:

The Secretary of War is hereby authorized and directed to cause a survey and an estimate of cost to be made of a breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck, with a view to protecting the said causeway, which forms one boundary of Marblehead Harbor, from destruction or injury by the sea, and to report to Congress the said estimate: and so much of the one thousand dollars as was appropriated for the repair of the sea

wall at Marblehead in the act of March third, eighteen hundred and ninety-nine, as is unexpended and may be necessary is hereby made available for the purposes of said survey and estimate.

Marblehead Harbor is about 12 miles north of Boston, Mass. It is well sheltered on the west by the mainland, on the east by Marblehead Neck, and on the south by a narrow causeway leading from Marblehead to Marblehead Neck. The harbor is entered from the north and embraces an area of about 200 acres of a depth of 12 feet and over.

The causeway protecting the harbor on the south is about 2,000 feet long, with an average width of 125 feet between high-water lines and a least width of 100 feet. Its southern beach is exposed to the full sweep of the ocean from the southeast. Its northern beach below the high-water level slopes gradually toward the harbor. The crest of the causeway has an average height of about 18.5 feet above mean low water. The lowest point is at the extreme eastern end, where it is but 16.4 feet above mean low water, and the highest not far from the middle, where its maximum height is 20.8 feet. The mean rise and fall of the tide is 9.3 feet, so that the average height of the crest of the causeway above mean high water is about 9.2 feet. Crossing the causeway is a well-traveled and well-kept roadway, which has a height above mean low water varying from 16 to 17 feet. The northern or harbor side of this roadway is supported by a substantial dry rubble wall. On the south side of the roadway, and rising from 2 to 4 feet above it, is a stone wall, which is reported to have been built by the United States early in the last century. The outlines of the wall are well defined from one end to the other of the causeway, although some parts of it have been entirely covered by shingle and cobblestones which have been thrown up by the sea. This wall, which is built of rough dry rubble of rather small sizes, varies from 6 to 30 feet in width on top and forms the backbone of the isthmus.

The protection of Marblehead Harbor by a sea wall to be built across the causeway has heretofore been the subject of several reports.

(a) Under date of July 13, 1889, Lieut. Col. S. M. Mansfield, Corps of Engineers, reported—

After a careful examination of the neck of land at the head of Marblehead Bay. I am satisfied that there is not the least prospect of the sea ever making a breach in it to the injury of the harbor. Any extension of the wall along it would only be of benefit to the highway, in which the Government has no special interest.

(b) Again, under date of February 4, 1897, Lieutenant-Colonel Mansfield submitted a report of a survey of the isthmus connecting Marblehead Neck with the town of Marblehead, which was made in compliance with a proviso in the river and harbor act of June 3, 1896, in which he stated—

There appears to be no local demand for the improvement of the harbor, and it is difficult to conceive of how it could be improved, and therefore no estimate of cost is submitted.

(c) Under date of November 14, 1899, Maj. W. L. Fisk, Corps of Engineers, submitted a report in reference to the repair of the sea wall at Marblehead, for which an appropriation of \$1,000 was made by the act of Congress approved March 3, 1899, in which he stated that he had inspected the wall throughout and could find no necessity for any repairs, and he stated further—

There is apparently no possible danger of cutting through the neck, and the exposed portion of the sea wall is perfectly protected by an immense volume of shingle which has been thrown against and over it until it is buried out of sight.

If it is desired to prevent this shingle being thrown over into the road, the wall would have to be considerably higher than it now is for probably one-half its length of about 2,000 feet, and the available money would not begin to suffice.

A tracing^a of a survey of the causeway made in July, 1903, is forwarded herewith, as well as a tracing^a from a survey made under direction of Lieutenant-Colonel Mansfield in 1896. A comparison of these two surveys shows them to be almost identical. What little difference there is could be very easily accounted for by the irregular and sandy or rocky character of nearly all of the ground covered by the survey. Two surveys of this ground made by two different men on consecutive days might, on account of its character, easily show as great difference as is shown in these two. In other words, the comparison of these two surveys made seven years apart, shows that instead of any wearing away of the beach or other marked change which would endanger the causeway, the conditions are remarkably stable. A personal examination of the ground showed that while the stones forming the wall on the south of the road were irregularly placed, none of them appeared to have been thrown far out of their original positions, and there was nothing to indicate any immediate danger to the harbor. Forwarded herewith are six photographs^a taken at different places on the causeway, which illustrate the general features of the causeway and harbor.

The greatest importance of the harbor of Marblehead is as a rendezvous for yachts during the summer months. Marblehead Neck is covered with summer cottages which, were the causeway washed out, would have no land connection with Marblehead and the surrounding country. Undoubtedly during heavy storms more or less shingle is thrown over the wall on to the road to the inconvenience of the people living on Marblehead Neck and probably to some expense to the town to repair the roadway.

The wording of the act is such that it appears mandatory to prepare an estimate of the cost of building a breakwater, and an estimate is accordingly submitted for a rough rubble wall laid in mortar, with its top at an elevation of 21 feet above mean low water, 6 feet wide, 9 feet high, and 2,100 feet long, to be built approximately on the line now occupied by the old wall. The stone in the old wall can be used and, it is estimated, will be sufficient for the construction of the new wall, but as it will be necessary to make considerable excavation in addition to handling the stone in the wall, it is estimated that the wall will cost \$6 per cubic yard, or a total cost of \$25,200.

The following commercial statistics of the harbor of Marblehead for the calendar year 1902 have been furnished by the collector of customs:

Amount of revenue collected, \$127.97.

	Number.	Ton- nage.
ENTRANCES.		
Foreign.....	3	291
Coastwise.....	32	12,550
CLEARANCES.		
Foreign.....	4	549
Coastwise.....	32	12,550

^a Not printed.

Shipments and receipts.

	Tons.
Coal.....	9,902
Sand.....	400
Granite.....	8,000
Wood.....	512
Lime.....	176
Cement.....	166
Brick.....	5,000
Total.....	24,156

Steam barges, tugs, war ships, yachts, and all kinds of sailing vessels, with a draft from 6 feet to 18 feet, frequent the harbor.

There were 4,514 arrivals of vessels of all classes during the year, with a tonnage of from 5 to 3,000.

Very respectfully, your obedient servant.

HARRY TAYLOR,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, August 14, 1903.

Respectfully forwarded to the Chief of Engineers, U. S. Army, recommended so far as concerns the amount of the estimate presented. There is not, however, in my opinion, the slightest necessity for any work here at the expense of the United States.

CHAS. R. SUTER,
Colonel, Corps of Engineers, Division Engineer.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 18, 1903.

Respectfully referred to the Board of Engineers for Rivers and Harbors constituted by Special Orders, No. 24, Headquarters Corps of Engineers, series of 1902, for consideration and recommendation.

By order of the Acting Chief of Engineers:

H. F. HODGES.
Major, Corps of Engineers.

[Third indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., August 21, 1903.

Respectfully returned to the Chief of Engineers, U. S. Army.

The Board of Engineers for Rivers and Harbors has considered the within report of the district officer on a survey of a "breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck, with a view to protecting the said causeway, which forms one boundary of Marblehead Harbor, from destruction or injury by the sea," the indorsement of the division engineer thereon and other data available.

The only interest the United States has in the stability of the strip of land connecting Marblehead and Marblehead Neck is that the breaching of this strip would involve great damage to Marblehead Harbor. The protection of the roadway from the wash of storm waves and from stones that the waves may cast upon it does not rise to the dignity of a work of national utility and importance, and at all events has no connection whatever with the maintenance of Marblehead Harbor or of the advancement of the interests of navigation. It appears that there is absolutely no danger of the sea cutting through Marblehead Beach and that, due to accretions of shingle, the security of this strip of land is increasing with time.

Accordingly the Board agrees with the district officer and division engineer in the opinion that it is not desirable for the United States to build a "breakwater upon the southerly side of the causeway leading from Marblehead to Marblehead Neck."

For the Board:

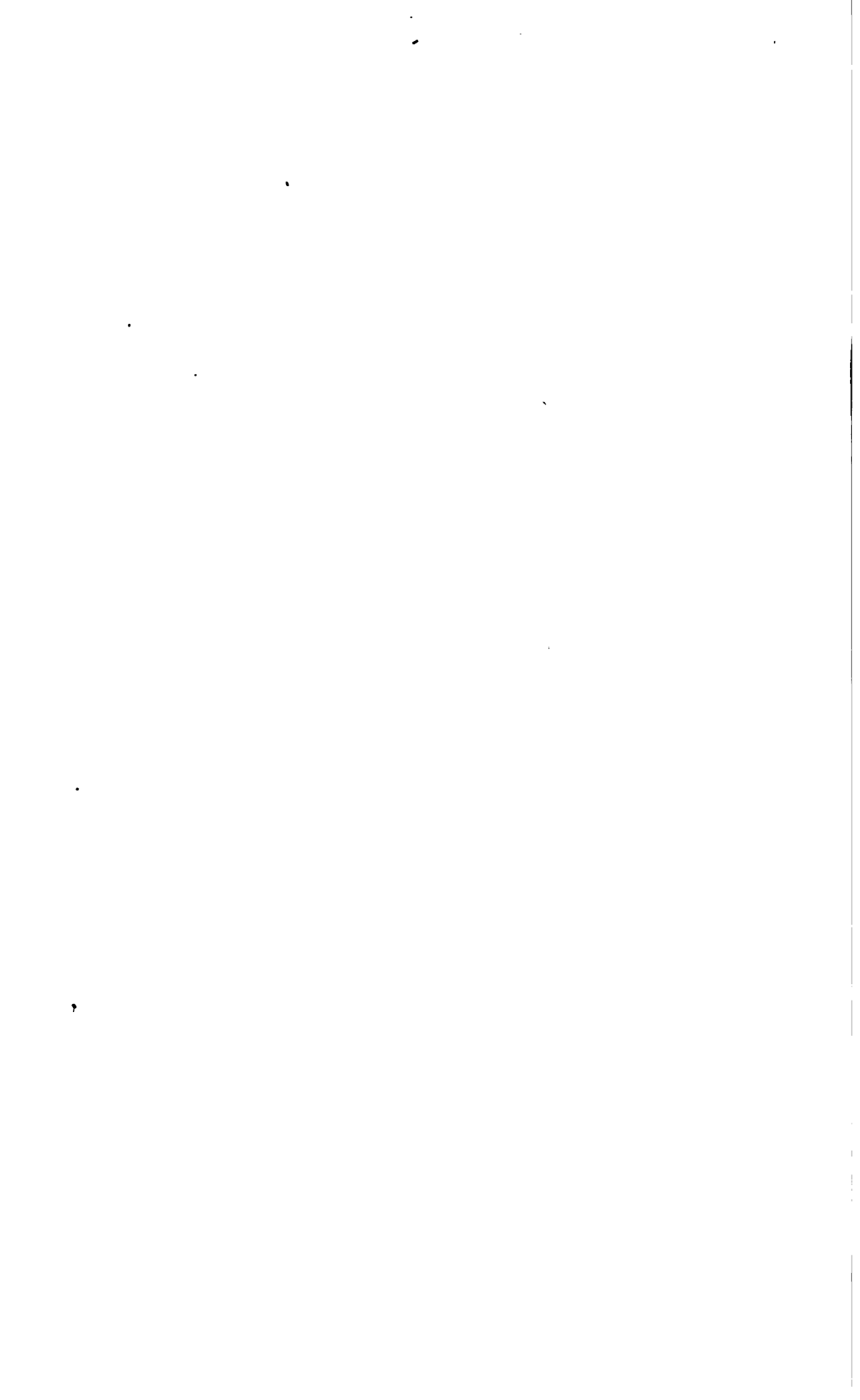
CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers,
Senior Member of Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 17, 1903.

The views of the Board of Engineers for Rivers and Harbors, as expressed in the preceding indorsement, are concurred in.

G. L. GILLESPIE,
Brig. Gen. Chief of Engineers,
U. S. Army.



APPENDIX C.

IMPROVEMENT OF RIVERS AND HARBORS IN EASTERN MASSACHUSETTS SOUTH OF AND INCLUDING LYNN HARBOR.

REPORT OF LIEUT. COL. W. S. STANTON, CORPS OF ENGINEERS,
OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903,
WITH OTHER DOCUMENTS RELATING TO THE WORK.

IMPROVEMENTS.

- | | |
|--|---|
| 1. Harbor at Lynn, Massachusetts. | 6. Harbor at Scituate, Massachusetts. |
| 2. Mystic and Malden rivers and Mystic River below the mouth of Island End River, Massachusetts. | 7. Harbor at Duxbury, Massachusetts. |
| 3. Harbor at Boston, Massachusetts. | 8. Harbors at Plymouth and Provincetown, Massachusetts. |
| 4. Weymouth and Town rivers, Massachusetts. | 9. Harbor at Chatham, Massachusetts. |
| 5. Harbor at Cohasset, Massachusetts. | 10. Removing sunken vessels or craft obstructing or endangering navigation. |
-

UNITED STATES ENGINEER OFFICE,
Boston, Mass., July 17, 1903.

GENERAL: I have the honor to transmit herewith annual reports for the works of river and harbor improvement in my charge for the fiscal year ended June 30, 1903.

Very respectfully, your obedient servant,

W. S. STANTON,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

C 1.

IMPROVEMENT OF HARBOR AT LYNN, MASSACHUSETTS.

Under the present project of June 13, 1902, dredging commenced under the contract with Bay State Dredging Company on October 14, 1902, was suspended December 24, 1902, on account of the exposed location of the work during the winter, was resumed April 21, and to June 30, 1903, 44,783 cubic yards of mud, sand, gravel, and clay were dredged in the outer main ship channel, deepening it to 15 feet at mean low water, as required by the project, for a width of 100 feet

and extending from the deep basin opposite Little Nahant, a distance of 2,600 feet, to a point 2,000 feet from that depth in the sea.

Under the project of April 10, 1884, as modified in 1888, under the aforesaid contract, there were dredged to the depth of 10 feet at mean low water 356 cubic yards of mud and riprap stone from the site of a former lighted beacon in the channel.

It is proposed to apply the available balance and additional appropriation recommended to extending the channel 15 feet deep at mean low water to the turning basin, part of the width prescribed in the project, and to dredging a part of the turning basin to that depth.

PROJECT OF 1884 FOR 10-FOOT CHANNEL.

Money statement.

July 1, 1902, balance unexpended.....	\$6,575.26
June 30, 1903, amount expended during fiscal year.....	138.82
July 1, 1903, balance unexpended.....	6,436.44
Amount (estimated) required for completion of existing project.....	53,500.00

PROJECT OF 1902 FOR 15-FOOT CHANNEL.

Money statement.

July 1, 1902, balance unexpended.....	\$25,000.00
June 30, 1903, amount expended during fiscal year.....	9,420.38
July 1, 1903, balance unexpended.....	15,579.62
July 1, 1903, outstanding liabilities.....	2,672.23
July 1, 1903, balance available.....	12,907.39
July 1, 1903, amount covered by uncompleted contracts.....	11,717.33
Amount (estimated) required for completion of existing project.....	137,936.84
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	75,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this work are as follows:

Act of—	Act of—
August 2, 1882.....\$60,000	August 18, 1894.....\$7,500
August 5, 1886.....6,000	June 3, 1896.....20,000
August 11, 1888.....10,000	June 13, 1902.....25,000
September 19, 1890.....15,000	
July 13, 1892.....10,000	Total.....153,500

LIST OF CONTRACTS IN FORCE JUNE 30, 1903.

Contract dated October 9, 1902, to dredge 95,000 cubic yards, more or less, of material from Lynn Harbor, Massachusetts (and 80,000 cubic yards, more or less, of material from Mystic River, Massachusetts), at 23.5 cents per cubic yard: approved November 15, 1902. To be commenced December 8, 1902; to be completed February 8, 1904.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1902.

[Through the courtesy of the collector of customs at Marblehead, Mass.]

Shipping.

Vessels.	Number.	Vessels.	Number.
Entrances:		Clearances:	
Foreign	24	Foreign	25
Domestic	297	Domestic	274

Amount of revenue collected fiscal year 1903, \$4,778.16.

Water freight, 1902.

	Quantity.	Tons.
Coal.....	157,763	157,763
Potatoes.....	170	14
Railroad ties.....	19,771	1,251
Lumber.....	8,800,000	4,125
Laths.....	55,000	11
Lime and cement.....	5,000	1,000
Brick.....	130,000	261
Firewood.....	425	709
Merchandise.....	165,000	165,000
Miscellaneous.....	31,428	31,428
Total.....		361,562

C 2.

IMPROVEMENT OF MYSTIC AND MALDEN RIVERS, AND MYSTIC RIVER BELOW THE MOUTH OF ISLAND END RIVER, MASSACHUSETTS.

(A) MYSTIC RIVER.

For the reason that the amount of funds available was too small for advantageous expenditure, no work was done during the fiscal year.

It is proposed to apply the available balance and the additional appropriation recommended to making the entire improvement under one contract.

(B) MALDEN RIVER.

That part of the river embraced in the project above the first bridge at Malden having been reported unworthy of improvement June 28, 1902, that part of the river below that bridge, the improvement of which had been completed in 1897 in accordance with the project, was surveyed in August, 1902, preliminary to the application of the amount available for maintenance of the improvement. But the lowest bid—48 cents per cubic yard for dredging 9,375 cubic yards, more or less—being too high, was rejected, and no work was done during the fiscal year.

On June 24, 1903, the shoaling having become so obstructive to the ascent of barges with coal to Malden, emergency contract was made for dredging the shoalest part of the channel.

June 3, 1903, it was reported to the Chief of Engineers that that part of the project embracing the channel to the first bridge at Malden was completed in 1897, at a cost of \$24,986.39, and that its maintenance

had cost to June 3, 1903, \$7,662.83, and that by the survey of August, 1902, it was found that to restore the channel to the dimensions obtained under the project would cost a further sum of \$30,679.97, entailing a total expenditure for maintenance of \$38,342.80 in the six years since the channel was completed.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the improvement up to the first bridge at Malden.

Money statement.

July 1, 1902, balance unexpended	\$8,500.00
June 30, 1903, amount expended during fiscal year	150.72
July 1, 1903, balance unexpended	8,349.28
July 1, 1903, amount covered by uncompleted contracts	2,880.00
(Amount (estimated) required for completion of existing project	16,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$6,500.00
For maintenance of improvement	25,830.69
	32,330.69
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of appropriations for these works are as follows:

For Malden River, by act of August 2, 1882	\$10,000
For Mystic and Malden rivers, by act of July 13, 1892	10,000
For Mystic and Malden rivers, by act of August 18, 1894	10,000
For Mystic and Malden rivers, by act of June 3, 1896	10,000
For Mystic and Malden rivers, by act of March 3, 1899	5,000
For Malden River, by act of June 6, 1900	5,000
For Mystic River, by act of June 13, 1902	1,000
For Malden River, by act of June 13, 1902	5,000
Total	56,000

ABSTRACT OF CONTRACT IN FORCE JUNE 30, 1903.

Emergency contract, dated June 24, to dredge 6,000 cubic yards, more or less, of material from Malden River, Massachusetts, at 48 cents per cubic yard, to be commenced by July 4 and to be completed by September 4, 1903.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1902.

[Furnished by wharf owners on the river.]

Mystic River.

	Tons.
Coal	2,500
Molasses	1,000

Malden River.

Coal	75,000
Molding sand, etc	5,000
Tanbark	700

(C) MYSTIC RIVER BELOW THE MOUTH OF ISLAND END RIVER,
MASSACHUSETTS.

Under the contract with the Bay State Dredging Company, 81,241.5 cubic yards of mud, sand, and clay were dredged from the channel at the confluence of Island End River February 10 to June 19, 1903, when the contract was completed.

This dredging, to the depth of 25 feet at mean low water, widens to the minimum width of 150 feet the channel that had previously been dredged above Chelsea bridge, and extends it 400 feet upstream with the width of 300 feet, all improvement. For maintenance \$281.92 was expended for removing, in April, a mass of water-logged timber which lodged in the draw of the Chelsea bridge and diminished the depth from 25 to 21 feet.

It is proposed to apply the available balance and the additional appropriation recommended to improvement.

Money statement.

July 1, 1902, balance unexpended	\$21,286.88
June 30, 1903, amount expended during fiscal year	19,039.84
July 1, 1903, balance unexpended	2,247.04
July 1, 1903, outstanding liabilities	1,972.50
July 1, 1903, balance available	274.54
{ Amount (estimated) required for completion of existing project	198,547.50
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	133,547.50
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of appropriations for this work are as follows:

Act of—	
March 3, 1899	\$50,000
June 13, 1902	19,000
Total	69,000

ABSTRACT OF CONTRACT IN FORCE JUNE 30, 1903.

Contract dated October 9, 1902, to dredge 80,000 cubic yards, more or less, of material from Mystic River, Massachusetts (and 95,000 cubic yards, more or less, from Lynn Harbor, Massachusetts), at 23.5 cents per cubic yard; approved November 15, 1902; to be commenced December 8, 1902; to be completed February 8, 1904.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1902.

[Furnished by wharf owners on the river.]

	Tons
Coal	1,365,887
Pitch, tar, and oil	20,000
Molasses	1,000
Molding sand, etc.	5,000
Coke	1,000
Lumber and miscellaneous	202,200
Total	1,595,087

C 3.

IMPROVEMENT OF HARBOR AT BOSTON, MASSACHUSETTS.

MAIN SHIP CHANNEL.

* * * * *

During the fiscal year 12,260 cubic yards of mud, sand, gravel, and clay were dredged from the upper main ship channel under the continuing contract with Breymann Brothers, of Toledo, Ohio, to December 16, 1902, when the contract was completed.

Under that contract the total amount dredged from the upper and lower main ship channels October 25, 1897, to December 16, 1902, was 2,981,356 cubic yards of mud, etc., at $17\frac{1}{2}$ cents per cubic yard, and 159.14 cubic yards of bowlders, weighing over 6 tons each, at \$12 per cubic yard.

Under the contract with G. H. Breymann & Bros. for the removal of 19,008 cubic yards of rock from twenty-one ledges covering 3.7 acres in the lower main ship channel, drilling with one drill boat equipped with three steam drills commenced October 25, 1902. To June 30 1,651 holes had been drilled and blasted, 1,581 of them in ledge No. 30 and 70 in ledge 30b. No rock has yet been removed under the contract. Many interruptions have occurred and much time has been lost by defective plant and by the weather. June 9 the contractors put a second drill boat in operation, more than doubling the capacity of the plant.

The sweeping of the lower main ship channel, $3\frac{1}{2}$ miles long and embracing 413 acres, which was commenced May 31, was completed September 21 and found many small areas from a few tenths to 2 or 3 feet or more shoal. By their examination, in part with a diver, until December, 1902, three of them were found to be dangerous ledges of rock, containing 223 cubic yards, upon which the least depth at mean low water was 25.6, 25.1, and only 23.5 feet, the latter being near mid-channel.

Much of the shoaling has doubtless been caused by caving from Lovells and Georges islands, and there is reason to believe that some of the shoals have been made by unlawful dumping.

September, 1902, to January, 1903, the remaining ledges uncovered by dredging and a small ledge and a small group of rocky points found bysweeping in the upper main ship channel and the three ledges so found in the lower main ship channel were surveyed. These thirteen ledges or groups of ledges, covering 1 acre and containing 3,627 cubic yards, embrace all the rock excavation (apart from the 19,008 cubic yards in the Breymann contract) required to complete the project of 1892. Proposals for their removal received May 26, 1903, were too high and were rejected. Proposals for their removal, except 1,338 cubic yards in that part of the upper main ship channel where dredging is now in progress under the 35-foot project, will be again invited in July.

It is proposed to apply the available balance to completing the rock excavation in the upper and lower main ship channels and in redredging to remove the shoaling in the lower main ship channel.

BROAD SOUND CHANNEL.

* * * * *

During the fiscal year 240,681.5 cubic yards of mud, sand, gravel, and clay, and 85.46 cubic yards of bowlders, weighing each over 6

tons, were dredged from the channel, all under the contract with G. H. Breymann and Bros. Owing to exposure to the sea dredging was suspended January 5 to May 25.

Sweeping the channel, which was commenced in July, was continued into November, and 576 acres were swept. There are so many ledges in the vicinity of this approach to Boston Harbor the sweeping extended $1\frac{1}{2}$ miles seaward of the dredged area and one-fourth mile beyond it, into President Roads. The sweeping found in the roads nearly on the prolongation of the mid-channel line and in 36 feet of water a ledge on which the depth was only 25.5 feet at mean low water. It was removed in December to the depth of 30 feet at mean low water by the excavation of 21.33 cubic yards by exploding dynamite in the seams and clearing away the broken rock by a sloop with hoist and diver.

The sweeping found a clear depth in the channel of 28 feet at mean low water for a width of 930 feet, the removal of many small shoals and ridges left in dredging being required to obtain the prescribed depth of 30 feet at mean low water.

Range lights for this channel were exhibited on Lovells and Spectacle islands and the channel buoyed for navigation April 10, 1903, by the Light-House Establishment.

It is proposed to apply the available balance in dredging and rock excavation necessary to complete the channel 1,200 feet wide and 30 feet deep at mean low water.

THIRTY-FIVE-FOOT CHANNELS.

* * * * *

The river and harbor act of June 13, 1902, appropriated \$600,000 and authorized continuing contracts to the extent of \$3,000,000 additional.

August 18, 1902, the Secretary of War allotted of the amount appropriated \$500,000, and apportioned of the amount to be appropriated \$2,400,000 (altogether \$2,900,000) to dredging.

Bids for the dredging were opened October 30, 1902. The lowest responsible bids were too high and were rejected. Bids were again opened January 22 and were accepted February 11. They were \$132,540 less in amount than the lowest responsible bids before rejected.

A separate contract was made for dredging each of the four divisions of the work. * * *

Dredging in section 2 of division 2, under the contract with Morris & Cumings Dredging Company, commenced April 10, 1903, and to June 30, 60,881 cubic yards of clay and 4.2 cubic yards of bowlders, weighing over 6 tons each, were dredged. This dredging has been over the area of ledges at the upper middle in the upper main ship channel, that the ledges may be uncovered, surveyed, and placed under contract for removal as early as practicable; to June 30, 2.35 acres of ledge have been uncovered.

It is proposed to apply the available balance and the appropriation recommended to dredging and rock excavation.

MAINTENANCE.

SEA WALLS.

On Deer Island large parts of the three sea walls at the North, South, and Middle Heads were demolished by the sea in November, 1898. The

rebuilding of the wall at the Middle Head, which was commenced in May, 1901, was completed June 30, 1903, and the rebuilding of the wall at the North Head, which was commenced in April, 1902, was finished June 30, 1903. Nine hundred and thirty-nine linear feet of it were rebuilt during the fiscal year just closed. The rebuilding of the wall at the South Head was commenced June 1, 1903.

During the fiscal year there were placed in the three walls 3,602 cubic yards of stone and concrete masonry, 7,793 cubic yards of back filling, 3,550 square yards of paving, 800 tons of riprap stone, and 4,661 linear feet of joints were repointed.

On Castle Island a few coping stones were set in the sea wall and other minor repairs made to it.

On Georges Island 213 feet of coping course were reset and other minor repairs made.

On Gallops Island the concrete foundation, which was extensively washed out by the sea, was renewed and minor repairs made at the southeast corner of the wall, and the entire wall, 2,320 feet in length, was repointed.

On Great Brewster Island 301 linear feet of wall were repointed, completing the repointing of the entire wall, which was begun in 1901.

On Long Island the repointing of the wall was commenced in June, and the repointing of 450 feet of it has been completed.

For the protection of the beach on the easterly side near Long Island Head 270 linear feet of groins were built by hired labor, of timber and planks.

It is proposed to apply the available balance and the additional appropriation recommended to the repair of the sea walls in Boston Harbor; to protecting their foundations and the easterly shore of Long Island with riprap; to dredging, under the projects for improvement, of Charles River, Fort Point Channel, and Chelsea Creek.

TRIBUTARY CHANNELS.

Charles River.—The river and harbor act of September 19, 1890, appropriated—

twenty thousand dollars for continuing improvement of Charles River: *Provided.* That no expenditure of said twenty thousand dollars shall be made until the draws in the Arsenal street and Market street bridges shall be made to conform to the projected channel without cost to the United States.

To June 7, 1884, the improvement was completed up to Arsenal Street Bridge, on which date the work was discontinued to await the alteration of the bridges to conform to the requirement in the above act. The improvement remaining to be made under the project is to extend the channel 80 feet wide and 6 feet deep 3,900 feet, to the Market Street Bridge, and from Market Street Bridge 8,725 feet, to the dam at Watertown, 60 feet wide and 2 feet deep.

The Arsenal Street Bridge has been altered to conform to the foregoing requirements, but the alteration has not been made in the Market Street Bridge, and no work has been done on the improvement during the fiscal year.

By provisos in the following acts of Congress amounts as follows have been appropriated for this improvement from appropriations for the improvement of Boston Harbor:

Act of—	
June 14, 1880	\$22,500
March 3, 1881	35,000
September 19, 1890	20,000
Total	77,500
Amount not yet appropriated	47,500
Total estimated cost of existing project	125,000

There is available for this improvement \$20,000, appropriated by the act of September 19, 1890, which amount is included in the "balance available, \$88,592.92," shown in the money statement for "General Improvement, Boston Harbor."

Fort Point channel.—For the reason that funds are not available, no work has been done on this improvement during the fiscal year ended June 30, 1903.

There has been appropriated for this improvement, from appropriations for the improvement of Boston Harbor, by proviso in the—

Act of August 5, 1886	\$18,750
Amount not yet appropriated	60,000
Total estimated cost of existing project	78,750

Chelsea Creek.—During the fiscal year 4,732 cubic yards of mud were dredged (July 1 to 12) from the channel under the contract with Bay State Dredging Company of May 28, 1902, at 25 cents per cubic yard.

Under that contract from June 2, 1902, to its completion, July 12, 1902, 17,988 cubic yards were dredged. A channel area was dredged 75 feet wide, 1,200 feet long, to the depth of 18 feet at mean high water through the bar 9,000 feet above the confluence with the Mystic River, and the channel for 1,000 feet next below Proctor's wharf was widened 50 feet to the depth of 14 feet at mean high water.

August 7 an allotment of \$3,000 from the appropriation for general improvement of harbor at Boston, Mass. (act of June 13, 1902), was made for extending the channel 14 feet deep at mean high water 150 feet in width to a point 200 feet above the wharf of the Suburban Gas and Electric Company. The bids, opened for this dredging December 2, 1902, were too high and were rejected.

It is proposed to apply the available balance and the additional appropriation recommended to dredging to complete the project.

There has been appropriated for this improvement, from appropriations for the improvement of Boston Harbor—

By proviso in act of June 3, 1896	\$7,000
By proviso in act of March 3, 1899	5,000
By allotment from appropriation act of June 13, 1902	3,000
Total	15,000
Amount not yet appropriated	50,000

Total estimated cost of existing project

65,000

There is available for this improvement \$2,997.06, which amount is included in the "balance available, \$88,592.92," shown in the money statement for "General Improvement, Boston Harbor."

Money statements.

PROJECT FOR GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended.....	\$143,935.64
June 30, 1903, amount expended during fiscal year	55,342.72
July 1, 1903, balance unexpended.....	88,592.92
July 1, 1903, outstanding liabilities.....	3,298.45
July 1, 1903, balance available	85,294.47
July 1, 1903, amount covered by uncompleted contracts	5,010.00
(Amount (estimated) required for completion of existing project.....	157,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$110,000.00
For maintenance of improvement	30,000.00
	140,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

PROJECT OF 1892.

July 1, 1902, balance unexpended.....	\$440,288.21
June 30, 1903, amount expended during fiscal year	79,391.89
July 1, 1903, balance unexpended.....	360,896.32
July 1, 1903, outstanding liabilities.....	244.10
July 1, 1903, balance available.....	360,652.22
July 1, 1903, amount covered by uncompleted contracts.....	184,947.84

PROJECT FOR BROAD SOUND CHANNEL.

July 1, 1902, balance unexpended.....	\$258,904.82
June 30, 1903, amount expended during fiscal year	102,896.88
July 1, 1903, balance unexpended.....	156,008.44
July 1, 1903, outstanding liabilities	21,705.35
July 1, 1903, balance available	134,303.09
July 1, 1903, amount covered by uncompleted contracts.....	1,424.78

PROJECT FOR THIRTY-FIVE-FOOT CHANNELS.

July 1, 1902, balance unexpended	\$800,000.00
Amount appropriated by sundry civil act, approved March 3, 1903	150,000.00
	750,000.00
June 30, 1903, amount expended during fiscal year	11,622.32
July 1, 1903, balance unexpended.....	738,377.68
July 1, 1903, outstanding liabilities.....	6,278.78
July 1, 1903, balance available	732,098.90
July 1, 1903, amount covered by uncompleted contracts	2,587,143.84
(Amount (estimated) required for completion of existing project....	7,244,248.68
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	650,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1825	\$52,972.56	June 23, 1874	\$100,000.00
March 19, 1828	2,000.00	March 3, 1875	100,000.00
May 23, 1828	87,000.00	August 14, 1876	50,000.00
March 2, 1829	7,310.54	June 18, 1878	55,000.00
March 2, 1831	5,000.00	March 3, 1879	50,000.00
March 2, 1831	12,390.00	June 14, 1880	75,000.00
February 24, 1832	9,000.00	March 3, 1881	100,000.00
July 3, 1832	60,000.00	August 2, 1882	96,500.00
July 4, 1836	15,000.00	July 5, 1884	5,000.00
July 7, 1838	7,353.00	August 5, 1886	56,250.00
March 3, 1841	1,000.00	August 11, 1888	125,000.00
March 3, 1841	1,500.00	September 19, 1890	145,000.00
August 31, 1842	2,000.00	July 13, 1892	300,000.00
March 3, 1843	16,000.00	August 18, 1894	200,000.00
July 20, 1848	40,000.00	June 3, 1896	70,000.00
August 30, 1852	30,000.00	June 4, 1897 ^a	400,000.00
July 2, 1864	40,000.00	July 1, 1898 ^a	250,000.00
July 2, 1864	10,000.00	March 3, 1899	75,000.00
February 28, 1865	8,000.00	March 3, 1899 ^a	163,751.00
February 28, 1865	20,000.00	June 6, 1900 ^a	317,000.00
June 12, 1866	50,000.00	March 3, 1901 ^a	133,000.00
July 12, 1866	75,000.00	June 13, 1902	100,000.00
March 2, 1867	375,000.00	June 13, 1902	600,000.00
July 11, 1870	100,000.00	June 28, 1902 ^a	175,000.00
March 3, 1871	100,000.00	March 3, 1903 ^a	150,000.00
June 10, 1872	75,000.00		
March 3, 1873	150,000.00	Total	5,238,027.10

ABSTRACT OF CONTRACTS IN FORCE JUNE 30, 1903.

THIRTY-FIVE-FOOT CHANNELS.

Division 1.—Contract dated February 25, 1903: Breymann Brothers, of Toledo, Ohio, contractors, to dredge 1,875,000 cubic yards, more or less, at 20 cents per cubic yard, from section 1, and 570,000 cubic yards, more or less, at 39 cents per cubic yard, from section 1a, total 2,445,000 cubic yards; approved March 12; to be commenced by September 16, 1903; to be completed by December 31, 1907.

Division 2.—Contract dated February 26, 1903: Morris & Cumings Dredging Company, of New York, N. Y., contractors, to dredge 1,875,000 cubic yards, more or less, at 23.4 cents per cubic yard, from section 2, and 570,000 cubic yards, more or less, at 40 cents per cubic yard, from section 2a, total 2,445,000 cubic yards; approved March 12, to be commenced by September 16, 1903; to be completed by December 31, 1907.

Division 3.—Contract dated February 25, 1903: George H. Breymann, of Toledo, Ohio, contractor, to dredge 1,875,000 cubic yards, more or less, at 23.5 cents per cubic yard, from section 3 and 570,000 cubic yards, more or less, at 39 cents per cubic yard, from section 3a, total 2,445,000 cubic yards; approved March 12; to be commenced by September 16, 1903; to be completed by December 31, 1907.

Division 4.—Contract dated February 19, 1903: Eastern Dredging Company and New England Dredging Company, of Boston, Mass., contractors, to dredge 1,875,000 cubic yards, more or less, at 23.9 cents per cubic yard, from section 4, and 570,000 cubic yards, more or less, at 39.7 cents per cubic yard, from section 4a, total 2,445,000 cubic yards; approved March 16; to be commenced by September 19, 1903; to be completed by December 31, 1907.

BROAD SOUND CHANNEL.

Contract dated March 13, 1900: G. H. Breymann & Bros., of Toledo, Ohio, contractors, to dredge 836,082 cubic yards, more or less, of material from Broad Sound channel, Boston Harbor, Massachusetts, at 35 cents per cubic yard; approved March 31, 1900; to be commenced July 1, 1900; to be completed June 30, 1902; time for completion waived for a reasonable period.

^a Sundry civil act.

TWENTY-SEVEN-FOOT CHANNEL.

Contract dated April 30, 1902: G. H. Breyman & Bros., of Toledo, Ohio, contractors, to excavate 19,008 cubic yards, more or less, of ledge in the lower main ship channel, Boston Harbor, Massachusetts, at \$9.73 per cubic yard situ measurement; approved June 3, 1902; to be commenced August 5, 1902; to be completed December 31, 1903.

LONG ISLAND.

Contract, dated May 22, 1903: Jos. J. Callahan, of Atlantic, Mass., contractor, to furnish 3,000 tons, more or less, of riprap stone and to build thereof a riprap dike for the protection of the shore on Long Island Head, Boston Harbor, Massachusetts, at \$1.67 per ton put in place; to be commenced by July 12 and to be completed by October 12, 1903.

COMMERCIAL STATISTICS FOR BOSTON HARBOR

The following statement concerning the foreign trade at the port of Boston is compiled from statistics and records of the Boston Chamber of Commerce, the collector of the port, and the foreign steamship lines entering this harbor. It comprises only imports and exports to foreign countries and does not include domestic, coastwise, and local traffic. Vessels engaged in the coastwise trade, unless they have in their cargoes bonded merchandise to the value of \$350 or more, are not required by law to take out clearance papers, and no statistics of their carrying trade are accessible.

The leading articles of imports into the United States at the port of Boston for the year ending December 31, 1902, were coal, sugar, steel, wool, cotton, and vegetable grasses, which aggregated 1,408,310 tons for the year.

The leading articles of export were provisions, cattle, wheat, flour, corn, cotton, and leather, which aggregated 847,322 tons for the year.

While in value the total exports to foreign countries, as shown by the following table, have fallen off materially, the port continues to hold its rank as the second port of the United States in the value of its foreign trade.

Year.	Imports.	Exports.	Total.
1901.....	\$65,236,991	\$131,667,890	\$197,004,881
1902.....	78,148,151	86,656,754	164,798,905

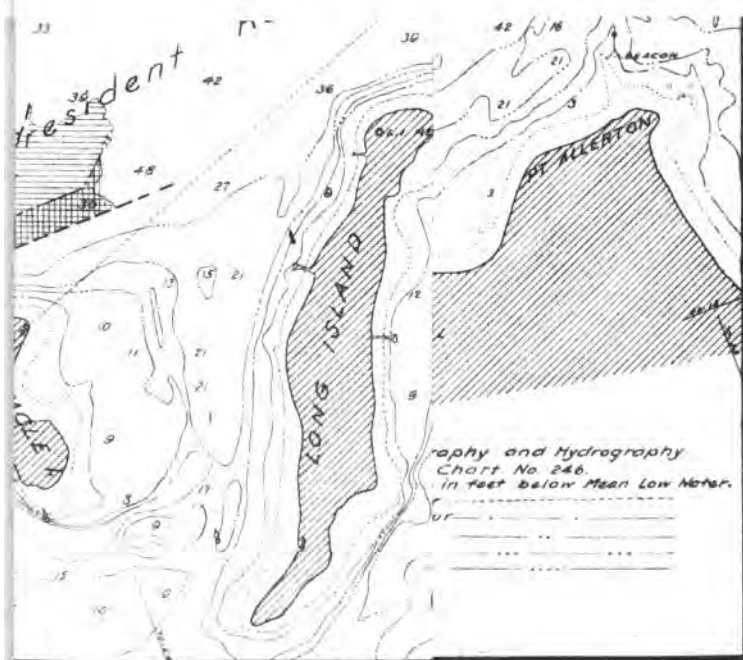
The trans-Atlantic passenger traffic of this port continues to increase rapidly. The figures of passengers carried in both directions for the past year show an increase of 52 per cent over the previous year and more than 300 per cent over the number carried five years ago.

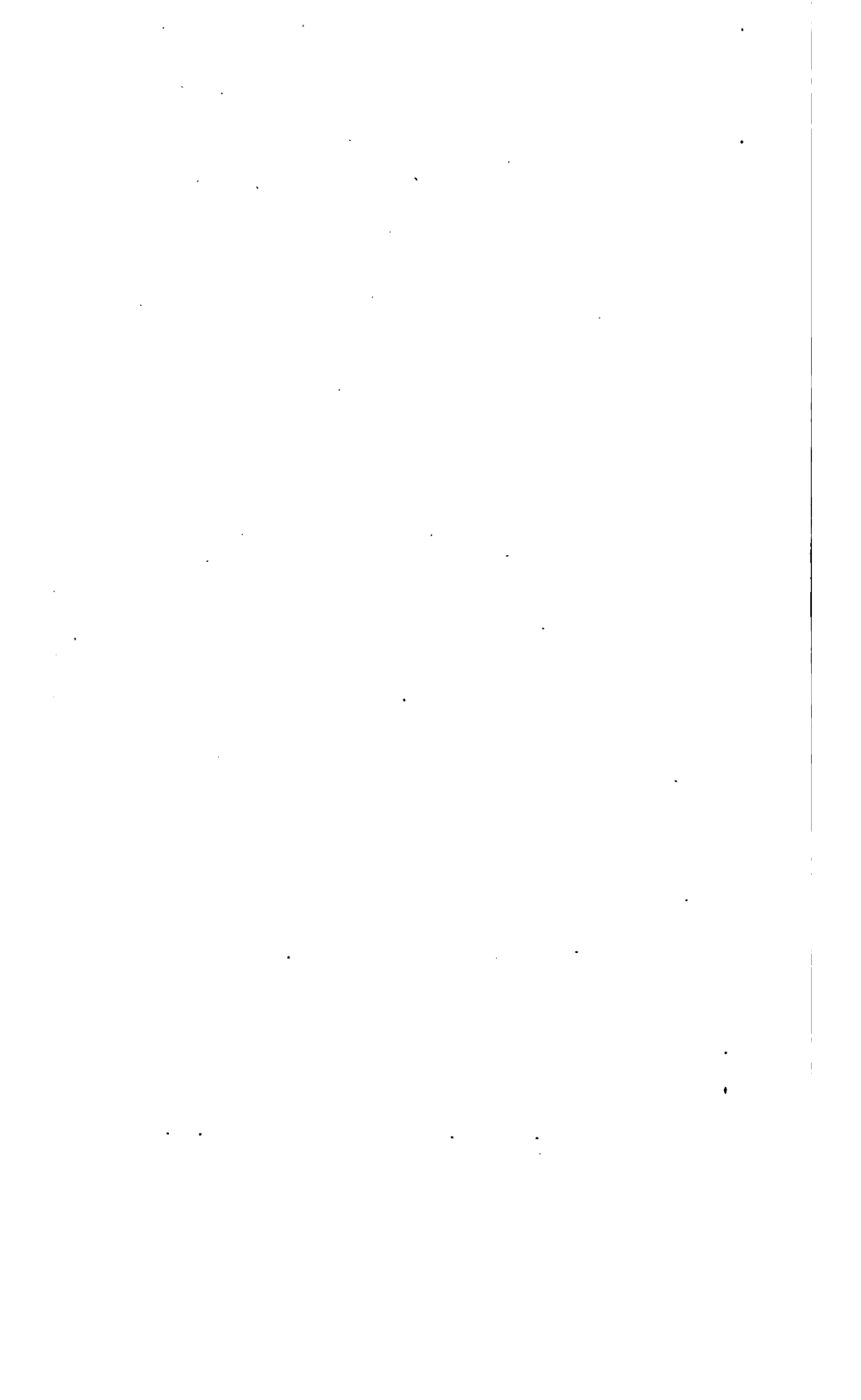
The Mediterranean service inaugurated in 1901 developed at once a passenger traffic of large dimensions, and during the year 1902 carried in both directions 20,436 passengers.

The following table shows the passenger movement during the past two years:

Arrived and sailed.	1901.	1902.
Cabin passengers.....	19,984	30,867
Steerage passengers.....	37,131	65,928
Total.....	57,065	86,849

Maximum draft of vessels leaving the harbor.....	feet.....	30
Maximum draft of vessels entering the harbor.....	do.....	37
Total sailings by steamship lines to European ports.....		349
Total collections of revenue by the collector of customs for the fiscal year ended June 30, 1903.....		\$24,028,856.41





Arrivals and departures during calendar year 1902.

Year.	Arrivals.			Clearances.		
	Coastwise.	Foreign.	Total.	Coastwise.	Foreign.	Total.
1901	10,415	1,957	12,372	2,141	1,824	3,965
1902	^a 8,516	1,868	10,414	2,366	1,648	4,044

^a Not including 3,981 vessels engaged in the fishing industry.

Tonnage of vessels arriving and leaving port of Boston during the calendar year 1902.

Year.	Foreign.			Coastwise.		
	Entrances.	Clearances.	Total.	Arrivals.	Tonnage.	Total tonnage in and out.
1901	2,475,436	2,210,686	4,686,122	10,415	8,724,118	17,448,236
1902	2,614,817	2,083,399	4,698,216	8,516	^a 7,291,981	14,583,862

TRIBUTARY CHANNELS.				1901.	1902.
(A) CHARLES RIVER.				Tons.	Tons.
Coal					10,000
(B) PORT POINT CHANNEL.					
Coal				432,674	296,567
Sugar				140,925	158,138
Molasses				21,200	12,230
Lumber				16,150	14,680
Merchandise				101,798	129,464
Total freight				712,747	611,094
Total passengers				8,200	8,200
(C) CHELSEA CREEK.					
Coal				12,000	5,000

^a Decrease due principally to the falling off in the receipts of coal, on account of the strike.

C 4.

IMPROVEMENT OF WEYMOUTH AND TOWN RIVERS, MASSACHUSETTS.

(A) WEYMOUTH RIVER.

That part of the channel under improvement was surveyed in August and October, 1902, to ascertain the most useful application that could be made of the amount of funds available. But the lowest bid, 37 cents per cubic yard, received January 5, 1903, for dredging was too high and the amount available was too small for advantageous expenditure. The bid was therefore rejected and no work was done during the year.

It is proposed to apply the available balance and the additional appropriation recommended as follows: To the completion of the improvement in Weymouth River, \$2,539.12; to the completion of the improvement in Weymouth Back River, \$10,246.41; total, \$12,785.53 for improvement, and to apply \$20,150.32 to maintenance of the improvement in Weymouth River.

Money statement.

July 1, 1902, balance unexpended	\$6,173.40
June 30, 1903, amount expended during fiscal year	137.87
July 1, 1903, balance unexpended	6,035.53
(Amount (estimated) required for completion of existing project	6,750.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$6,750.00
For maintenance of improvement	20,150.32
	26,900.32
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of the appropriations for this work are as follows:

Act of—	
September 19, 1890	\$10,000
July 13, 1892	10,000
August 18, 1894	5,000
June 3, 1896	15,000
March 3, 1899	10,000
June 13, 1902	5,250
Total	55,250

(B) TOWN RIVER.

That part of the channel under improvement was surveyed in August and September, 1902, to ascertain the most useful application that could be made of the funds available. But the lowest bid, 32 cents per cubic yard, received January 5, 1903, was too high to permit the funds to be advantageously expended. The bid was therefore rejected and no work was done during the fiscal year.

It is proposed to apply the available balance and the additional appropriation recommended to the maintenance of the channel already dredged and to the completion of the improvement: \$7,135.65 to completion and \$12,577.41 to maintenance.

Money statement.

July 1, 1902, balance unexpended	\$9,995.08
June 30, 1903, amount expended during fiscal year	109.43
July 1, 1903, balance unexpended	9,885.65
(Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	9,827.41
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of the appropriations for this work are as follows:

Act of—	
June 3, 1896	\$10,000.00
March 3, 1899	8,000.00
June 13, 1902	9,750.00
Total	27,750.00

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Furnished by wharf owners on the rivers.]

Weymouth (Fore) River.

	Tons.
Coal.....	64,215
Lumber.....	4,642
Laths.....	193
Lime.....	319
Shingles.....	80
Brick.....	131
Sand.....	120
Total.....	69,701

Weymouth (Back) River.

Coal.....	2,900
Iron.....	873
Lumber.....	563
Lime and cement.....	94
Brick.....	539
Raw and manufactured fertilizer products.....	96,788
Total.....	101,727

Town River.

Coal.....	10,680
Lumber, laths, and shingles.....	3,693
Stone.....	85,000
Total.....	99,373

C 5.

IMPROVEMENT OF COHASSET HARBOR, MASSACHUSETTS.

This improvement was begun May 28, 1903, from which day to June 30, under the contract with the Bay State Dredging Company, 10,330 cubic yards of mud, sand, gravel, and clay were dredged from the channel within the harbor.

The dredging uncovered a ledge of rock, for removing which, under emergency contract with the same company, drilling commenced June 2, and fifteen holes were drilled to June 30, 1903.

It is proposed to apply the additional appropriation recommended to extending the channel within the harbor to and along the wharves, to dredging a turning basin 350 feet by 350 feet, and to extending the channel from the entrance through the bar to the sea.

Money statement.

July 1, 1902, balance unexpended.....	\$10,000.00
June 30, 1903, amount expended during fiscal year.....	145.84
July 1, 1903, balance unexpended.....	9,854.66
July 1, 1903, outstanding liabilities.....	3,762.68
July 1, 1903, balance available.....	6,091.98
July 1, 1903, amount covered by uncompleted contracts.....	5,388.58
{ Amount (estimated) required for completion of existing project.....	11,670.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	11,670.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

The date and amount of appropriation for this harbor are as follows:

Act of June 13, 1902..... \$10,000

ABSTRACTS OF CONTRACTS IN FORCE JUNE 30, 1903.

Contract dated January 28, 1903, with Bay State Dredging Company, of Boston, Mass., contractors to dredge from the channel in Cohasset Harbor, Mass., 23,000 cubic yards, more or less, of material, at 34.75 cents per cubic yard; approved February 13; to be commenced May 15 and to be completed October 15, 1903.

Emergency contract dated June 24, 1903, with Bay State Dredging Company, of Boston, Mass., contractor, to remove 105 cubic yards, more or less, of ledge rock, at \$17 per cubic yard; to be commenced July 3 and to be completed August 14, 1903.

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1903.

[Furnished by Tower Bros. & Co., Cohasset, Mass.]

	Quantity.	Tons.
Coal.....tons..	200	200
Lumber.....feet..	400,000	500
• Total		700

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
WASHINGTON BARRACKS,
Washington, D. C., July 20, 1903.

GENERAL: By first indorsement, Office Chief of Engineers, United States Army, May 1, 1903, there was referred to the Board of Engineers for Rivers and Harbors a resolution adopted by the Committee on Rivers and Harbors of the House of Representatives, wherein there was required among other things the opinion of the Board upon the advisability of continuing the work of improvement at Cohasset Harbor, Massachusetts, or modifying the project therefor.

The Board has considered all the data available. On July 16, 1903, through a committee the Board inspected the locality and held, at Boston, a public hearing at which interested parties were given full opportunity to express their views.

Cohasset Harbor is a deep indentation lying about 8 miles southeast by south from Boston light. The outer roadstead has an average depth of about 10 feet and is sheltered from all but easterly winds. The entrances to the roadstead are bordered by reefs and shoals, which are very dangerous in heavy weather. The inner basin, on which the town is situated, is about 28 acres in area, is well sheltered, but is extremely shoal, nearly all of this area being bare at low water. The distance from the town docks to the 4-foot contour of the outer harbor is about 6,000 feet. The town has a population of about 2,700.

The project for the improvement of this harbor was adopted in 1902, the river and harbor act of that year appropriating \$10,000. It contemplates dredging a channel 4 feet deep at mean low water and 60 feet wide from the docks to the outer roadstead, this width to be increased to 75 feet at curves, and a basin in front of the wharves 350 by 350 feet. Estimated cost, \$21,670. With the funds made available by the last river and harbor act, a channel has been dug from the wharves almost to White Head, a distance of 4,000 feet. The basin remains to be excavated, also the channel through the outer (White Head) bar.

The present commerce of this place is insignificant, amounting annually to about 3,000 tons of coal and building material, and is strictly local. The outer roadstead is used to some extent as a place of refuge by light-draft vessels, and the inner waters; especially in summer, are used by pleasure craft. The provision of the projected channel can not develop a large or general commerce.

It was made apparent at the public hearing that all that local interests desire is the completion of the present project, with an easing of the sharp turn at Barson's Beach.

The Board believes that no modification of the project looking to a greater depth than is now contemplated is desirable and that the additional expenditure at this locality should be limited to such work as may be necessary to secure benefit from the dredging already done. To this end the Board recommends that the channel contemplated by the project be completed, but that the excavation of the turning basin be omitted. About one-half of the estimate has been appropriated. The omission of the turning basin will effect a saving of a considerable amount.

The physical conditions at this place are apparently such that the maintenance of the dredged channel will be expensive. When the channel, as recommended above, has been finished, the United States will have expended a considerable sum in securing benefits which are local rather than general in their nature. The Board therefore recommends that the amount necessary to complete this channel be appropriated in one sum, and that thereafter appropriations for this locality shall cease and the maintenance or further improvement of navigation facilities shall be left to those directly interested. In case it should seem impracticable to relieve the United States from the maintenance of this work, the Board recommends that the project be discontinued at once.

The Board further recommends that the district officer be directed to prepare an estimate of the cost of completing the work, as herein recommended.

Respectfully submitted.

CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers.
H. F. HODGES,
Major, Corps of Engineers.
EDW. BURR,
Major, Corps of Engineers.
C. H. MCKINSTRY,
Captain, Corps of Engineers.
W. V. JUDSON,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
July 25, 1903.

Respectfully referred to Lieut. Col. W. S. Stanton, Corps of Engineers, who will please prepare and submit the estimate herein recommended by the Board of Engineers for Rivers and Harbors.

This paper to be returned.

A. MACKENZIE,
Acting Chief of Engineers.

[Second indorsement.]

U. S. ENGINEER OFFICE,
Boston, Mass., August 3, 1903.

Respectfully returned to the Chief of Engineers, U. S. Army, with estimate of this date.

W. S. STANTON,
Lieut. Col., Corps of Engineers.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
September 24, 1903.

In view of all the facts presented in the within report of the Board of Engineers for Rivers and Harbors, I am of the opinion that the work of improving Cohasset Harbor should be discontinued and that no further appropriations should be made.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,
 U. S. Army.*

REPORT OF LIEUT. COL. W. S. STANTON, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., August 3, 1903.

GENERAL: In compliance with indorsement of July 25, 1903, I have the honor to report that the cost of completing the channel at Cohasset Harbor, Massachusetts, omitting from the project authorized by the act of June 13, 1902, the turning basin, in accordance with paragraph 7 of the letter addressed July 20, 1903, to the Chief of Engineers, by the Board of Engineers for Rivers and Harbors, is \$7,708.08, as follows:

To extend the channel from the outer end of the dredged channel completed July 21, 1903, through the bar to the sea, dredging Section A-B on tracing herewith, 15,021 cubic yards of sand and gravel, at 35 cents per yard	\$5,257.35
To extend the channel completed July 21, 1903, to the upper wharf, the limit of the channel embraced in the project authorized by the act aforesaid, dredging Section C on tracing, 5,000 cubic yards of mud, sand, and clay, at 35 cents per yard	1,750.00
Total	7,007.35
Contingencies, etc., 10 per cent.	700.73
Total	7,708.08

The price paid for dredging 20,269 cubic yards of mud, sand, gravel, and clay from this harbor, May to July, 1903, was 34½ cents per cubic yard.

Very respectfully, your obedient servant,

W. S. STANTON,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

C 6.

IMPROVEMENT OF HARBOR AT SCITUATE, MASSACHUSETTS.

For want of funds, no work has been done upon this improvement during the fiscal year ending June 30, 1903.

It is proposed to apply the available balance and the additional appropriation recommended to maintenance in restoring the present north breakwater to its former height and to redredging.

Money statement.

July 1, 1902, balance unexpended.....	\$148.06
July 1, 1903, balance unexpended.....	148.06
{ Amount (estimated) required for completion of existing project.....	186,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	7,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
March 2, 1829	\$180	September 19, 1890	\$10,000
August 30, 1852	1,000	July 13, 1892	10,000
June 14, 1880	7,500	August 18, 1894	10,000
March 3, 1881	10,000	June 3, 1896	6,000
August 2, 1882	10,000	March 3, 1899	15,000
July 5, 1884	10,000		
August 5, 1886	10,000	Total	104,680
August 11, 1888	5,000		

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1903.

	Tons.
Lumber	2,413
Shingles	700
Coal	2,301
Brick	636
Lime	138
Total	6,188

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
WASHINGTON BARRACKS,
Washington, D. C., July 27, 1903.

GENERAL: By first indorsement, Office Chief of Engineers, United States Army, May 1, 1903, there was referred to the Board of Engineers for Rivers and Harbors a resolution adopted by the Committee on Rivers and Harbors of the House of Representatives, wherein there was required, among other things, the opinion of the Board upon the advisability of continuing the work of improvement at Scituate Harbor, Massachusetts, or modifying the project therefor.

The Board has examined all the data available, including a report of the district officer dated August 7, 1902. On July 16, 1903, a committee of the Board inspected the locality and held a public hearing in Boston, at which interested parties were given full opportunity to express their views.

Scituate Harbor lies about midway between Boston light and Plymouth. In its original condition the depth on the bar was about 2.5 feet at mean low water, and the entrance was obstructed by many sunken bowlders; of the low-water area of about 57 acres only 6 acres had a depth of at least 3 feet at mean low water, and there was little protection against the sea.

The existing project for its improvement, adopted in 1881, is to build of rubblestone a north breakwater 800 feet and a south breakwater 730 feet long, to dredge an anchorage basin of 30 acres and an entrance channel 2,700 feet long and 300 feet wide, with depths at mean low water of 15 feet at the entrance, 12 to 15 feet between the breakwaters, 12 feet immediately back of the south breakwater, 10 feet in the anchorage basin, and 3 feet in the channel to the wharves, at an estimated cost of \$100,000 for the breakwaters and of \$190,000 for the dredging; total \$290,000.

By June 30, 1902, all known bowlders obstructing the entrance had been removed; the anchorage basin, 350 by 450 feet, had been dredged 7 feet deep at mean low water, and the channel from the sea to the basin had been dredged 7 feet deep, 100 feet wide, and 1,600 feet long; the channel, 2,150 feet long from the anchorage basin to the town wharves, had been dredged 3 feet at mean low water at least 150 feet wide, and 720 linear feet of the north breakwater and 450 linear feet of the south breakwater had been built. The governing depth in the entrance channel and basin was 7 feet on that date and 20 inches in the channel between the basin and the docks. The mean range of tide is 9.8 feet. This work had cost in all \$103,351.94.

It appears from the papers submitted at and subsequent to the holding of the public hearing that local interests desire the completion of the present project and, in addition thereto, the deepening of the channel from the anchorage basin to the docks to a depth of 6 feet instead of 3 feet, as contemplated by the present project.

The main purpose of undertaking work at Scituate was originally to provide a harbor of refuge. This appears from the wording of the river and harbor act of June 18, 1878, which directed a survey of the harbor "with a view to its adaptability as a harbor of refuge," from the memorials submitted in favor of the undertaking, and from the plans drawn up by the Engineer Department and approved by Congress. The advantages afforded by Scituate for this purpose were few, though more numerous than in the case of any other point along the stretch of coast on which a harbor of refuge was desired.

In his report of August 7, 1902, the district officer states:

It will be seen by the report of the Board of Engineers of September 13, 1880 (p. 524, Annual Report of the Chief of Engineers for 1881), that an important purpose of the project was to form a harbor of refuge for resort "by small and medium class vessels navigating the bay, as well as by those of larger class from without, driven to its vicinity by the severe northeast gales of winter." The locality has little or no natural advantage or adaptation to that purpose. Of the low-water area of 57 acres about 6 acres had a depth of at least 3 feet at mean low water, and an anchorage had to be created by heavy dredging. The contracted anchorage has so little natural protection, even with the breakwaters as now built, that the seas that are driven between them into the harbor in gales cause so much travel of the spit of coarse gravel and shingle at "A" (see tracing) it encroaches upon the channel and

has to be repeatedly redredged to maintain access to the wharf. The 12-foot and 15-foot contours (see chart in report of 1881) outside the harbor indicate that in easterly and northeasterly gales the sea breaks all along the front of the harbor and across the approach to the entrance. Even if the channel between the breakwaters be no narrower than now, it is not believed that any prudent master of a sailing vessel or tug with a barge would take the chance of making the entrance in a gale with all the risk of missing it and of losing his vessel either on the breakwaters or on the shore to the north or south. If the improvement were completed, it is believed that vessels would not seek, but rather would shun, the locality of the harbor in such weather. The "small and medium class vessels" for which the harbor of refuge was designed have to a very great extent disappeared, having been driven from commerce by schooners of three or more masts and by the towed barge.

In view of all these facts, the Board concurs in the opinion of the district officer that this place is not worthy of further improvement as a harbor of refuge.

As a commercial port, the needs of this place were to be served by a channel 3 feet deep at mean low water from the basin to the wharves. The present commerce amounts to about 15,000 tons annually, and consists of coal and building materials. These articles are distributed by team over an area within a radius of 15 or 20 miles, and to a population amounting to about 30,000. The population of Scituate is about 2,500.

It is becoming increasingly difficult to charter light-draft vessels suited to this port. A channel 6 feet deep at mean low water will probably accommodate the trade of Scituate for many years to come. Unless a channel from the basin to the wharves of about the same depth as that of the entrance channel and basin is provided, almost no advantage of work already done will be realized.

The Board believes that it is desirable for the United States to provide a channel 6 feet deep and 100 feet wide from the anchorage basin to the docks, provided the cost of the same will not be unreasonably great, and recommends that the district officer be directed to prepare an estimate of the cost of securing and maintaining such a channel.

Respectfully submitted.

CHAS. J. ALLEN,
Lieut. Col., Corps of Engineers.
H. F. HODGES,
Major, Corps of Engineers.
EDW. BURR,
Major, Corps of Engineers.
C. H. MCKINSTRY,
Captain, Corps of Engineers.
W. V. JUDSON,
Captain, Corps of Engineers.

Brig. Gen. G. I. GILLESPIE,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
July 31, 1903.

Respectfully referred to Lieut. Col. W. S. Stanton, Corps of Engineers, who will please prepare and submit at the earliest practicable date the estimate recommended by the Board.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
Colonel, Corps of Engineers.

[Second indorsement.]

U. S. ENGINEER OFFICE,
Boston, Mass., August 21, 1903.

Respectfully returned to the Chief of Engineers, U. S. Army, with estimate of this date.

W. S. STANTON,
Lieut. Col., Corps of Engineers.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
August 26, 1903.

Respectfully returned to the Board of Engineers for Rivers and Harbors, with estimate of cost as recommended.

By order of the Acting Chief of Engineers:

H. F. HODGES,
Major, Corps of Engineers.

[Fourth indorsement.]

BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, D. C., August 31, 1903.

Respectfully returned to the Chief of Engineers, U. S. Army.

It appears from the accompanying report of the district officer that a channel 6 feet deep at mean low water and 100 feet wide can be provided from the entrance to the docks at the reasonable cost of \$18,000; and the Board recommends the discontinuance of the present project for the improvement of Scituate Harbor and the adoption of a project for obtaining the channel described at the cost mentioned.

For the Board.

CHAS. J. ALLEN,
*Lieut. Col., Corps of Engineers,
Senior Member of the Board.*

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS, U. S. ARMY,
September 17, 1903.

The views of the Board of Engineers for Rivers and Harbors, as expressed in the preceding indorsement, are concurred in.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,
U. S. Army.*

REPORT OF LIEUT. COL. W. S. STANTON, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., August 21, 1903.

GENERAL: In compliance with indorsement of July 31, 1903, I have the honor to report that the cost of dredging a channel 6 feet deep and 100 feet wide from the anchorage basin to the docks in Scituate Harbor, Massachusetts, in accordance with paragraph 8 of the letter of July 27, 1903, from the Board of Engineers for Rivers and

Harbors to the Chief of Engineers, is estimated from the survey which has just been completed to be \$16,950.40, as follows:

Dredging 44,027 cubic yards, scow measurement, of mud, sand, gravel, and clay, at 35 cents per cubic yard	\$15,409.45
Engineering expenses and contingencies, 10 per cent	1,540.95
Total	16,950.40

To obtain a channel of the same depth and width from the anchorage basin to the sea will also require the expenditure of \$632.33, as follows:

Dredging 1,571 cubic yards, scow measurement, of sand and gravel, at 35 cents per cubic yard	\$549.85
Engineering expenses and contingencies, 15 per cent	82.48
Total	632.33

These two channels, one above and the other below the anchorage basin, are shown on the tracing^a herewith.

In December, 1899, the channel opposite Welch's wharf was dredged to the width of 100 feet and depth of 3 feet at mean low water. In June and July, 1901, a gravel spit had so encroached upon it that it had to be redredged to a width of 100 feet and depth of 3 feet at mean low water at a cost of \$1,989.11.

During the two years since 1901 there has been little deterioration. Unless long continued easterly storms should cause the further movement of the gravel spit into the channel it seems probable that the cost of maintenance would be insignificant.

Very respectfully, your obedient servant,

W. S. STANTON,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

C 7.

IMPROVEMENT OF HARBOR AT DUXBURY, MASSACHUSETTS.

For want of funds no work has been done upon this improvement during the fiscal year ended June 30, 1903.

It is proposed to apply the additional appropriation recommended to increasing the width of the channel to the widths authorized by the project and to maintenance in restoring the depth where the slight shoaling has occurred in the channel near the wharf.

Money statement.

{ Amount (estimated) required for completion of existing project	\$5,820.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	5,820.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

^a Not printed.

The dates and amounts of appropriations for this harbor are as follows:

Act of—	
July 4, 1836.....	\$5,000
June 10, 1872.....	10,000
March 3, 1873.....	10,000
March 3, 1899.....	12,000
Total.....	37,000

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1903.

Freight.

	Tons
Coal.....	323
Lumber.....	339
Shingles.....	99
Total.....	760

C 8.

IMPROVEMENT OF PLYMOUTH AND PROVINCETOWN HARBORS,
MASSACHUSETTS.

(A) PLYMOUTH HARBOR.

May 9 to 22, under the contract of February 18, 1903, with the Bay State Dredging Company, there were dredged 12,200 cubic yards of mud and sludge, at 29.75 cents per cubic yard, from the turning basin at the wharves.

The dredging restored to the depth of 9 feet at mean low water an area of about 3 acres which had been before redredged to that depth in 1899.

It is proposed to apply the available balance to returning the Eel River to its former course and to such extension as may be necessary of the dike of riprap stones on Long Beach.

Money statement.

July 1, 1902, balance unexpended.....	\$22,799.83
June 30, 1903, amount expended during fiscal year.....	4,251.49
July 1, 1903, balance unexpended.....	18,548.34
July 1, 1903, outstanding liabilities.....	1.25
July 1, 1893, balance available.....	18,547.09
July 1, 1903, amount covered by uncompleted contracts.....	3,276.21
Amount (estimated) required for completion of existing project....	20,700.00

The dates and amounts of appropriations for this harbor are as follows:

Act of—		Act of—	
May 26, 1824.....	\$20,000.00	June 18, 1878.....	\$5,000.00
March 3, 1825.....	5,712.00	March 3, 1879.....	3,500.00
March 25, 1826.....	13,184.90	June 14, 1880.....	10,000.00
April 23, 1830.....	1,850.00	March 3, 1881.....	10,000.00
March 2, 1831.....	2,820.00	August 2, 1882.....	14,000.00
July 3, 1832.....	2,500.00	July 5, 1884.....	10,000.00
March 2, 1833.....	600.00	August 5, 1886.....	6,000.00
June 28, 1834.....	2,000.00	August 11, 1888.....	6,000.00
March 3, 1835.....	700.00	September 19, 1890.....	8,000.00
July 2, 1836.....	500.00	July 13, 1892.....	9,500.00
July 7, 1838.....	2,400.00	August 18, 1894.....	1,500.00
August 31, 1852.....	5,000.00	June 3, 1896.....	1,500.00
July 11, 1870.....	10,000.00	March 3, 1899.....	} 10,000.00 75,000.00
March 3, 1871.....	10,000.00	June 13, 1902.....	
June 10, 1872.....	2,500.00		4,000.00
March 3, 1873.....	3,000.00		
June 23, 1874.....	5,000.00		
March 3, 1875.....	10,000.00	Total.....	271,766.90

ABSTRACT OF CONTRACTS IN FORCE JUNE 30, 1903.

Emergency contract dated June 22, 1903: Clark Finney, of Plymouth, Mass., contractor, to excavate 1,829 cubic yards, more or less, of material from the former bed of Eel River, Plymouth, Mass., at 49 cents per cubic yard; to be commenced July 6, 1903, and to be completed by August 22, 1903.

Emergency contract dated June 30, 1903: Wonson & Latimer, of Gloucester and Boston, Mass., contractors; to furnish 1,000 tons, more or less, of riprap stone, and to build thereof a riprap dike on the beach near Eel River, Plymouth, Mass., at \$2.38 per ton put in place; to be commenced July 30, 1903, and to be completed September 30, 1903.

COMMERCIAL STATISTICS FOR THE FISCAL YEAR 1903.

[Through the courtesy of the collector of customs at Plymouth, Mass.]

Amount of revenue collected.....\$216.13

Entrances and clearances.

Entrances—		Clearances—	
Foreign.....	2	Foreign.....	3
Domestic.....	57	Domestic.....	56

FREIGHT.

	Tons.
Coal.....	27,326
Lumber.....	2,000
	29,326

(B) PROVINCETOWN HARBOR.

In October to December, 1902, three groynes of timber and brush, 150 feet apart and 180 feet in length each, were built upon the beach at Abel Hill dike. The storms of February and March carried away the outer parts of them, reducing them uniformly to 36 feet in length. At the groynes the storm made no encroachment upon the sand dunes above the high-water line, which adjoining them and for a distance of about 9,000 feet were more or less cut away by the sea.

During the fiscal year slight repairs were made to the old sand and timber dike near the Abel Hill dike, and 545 feet of sand-catching fences were built upon the sand dunes.

It is proposed to apply the available balance and the additional appropriation recommended to works of protection for preserving and strengthening the barrier of beach and sand dunes that protects and preserves the harbor.

Money statement.

July 1, 1902, balance unexpended.....	\$16,888.02
June 30, 1903, amount expended during fiscal year.....	1,989.44
July 1, 1903, balance unexpended.....	<u>14,898.58</u>
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	
Submitted in compliance with requirements of sundry civil act of June 4, 1897.....	
	5,000.00

The dates and amounts of the appropriations for this work are as follows:

Act of—		Act of—	
May 19, 1826.....	\$3,500.00	June 18, 1878.....	\$1,000.00
March 2, 1829.....	3,500.00	March 3, 1879.....	1,000.00
March 2, 1831.....	2,050.00	June 14, 1880.....	500.00
March 3, 1832.....	4,600.00	March 3, 1881.....	5,000.00
June 28, 1834.....	4,400.00	August 2, 1882.....	5,000.00
March 3, 1835.....	4,400.00	July 5, 1884.....	2,000.00
July 2, 1836.....	4,400.00	August 5, 1886.....	3,000.00
July 7, 1838.....	4,500.00	August 11, 1888.....	3,000.00
August 30, 1852.....	5,000.00	September 19, 1890.....	7,500.00
June 23, 1866.....	43,068.44	July 13, 1892.....	1,500.00
July 28, 1866.....	8,000.00	August 18, 1894.....	1,500.00
March 3, 1871.....	6,000.00	June 3, 1896.....	1,500.00
June 10, 1872.....	5,000.00	March 3, 1899.....	10,000.00
March 3, 1873.....	6,000.00	June 13, 1902.....	11,000.00
June 23, 1874.....	6,000.00		
March 3, 1875.....	5,000.00	Total.....	<u>176,918.44</u>
August 14, 1876.....	4,000.00		

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Through the courtesy of the collector of customs, Barnstable, Mass.]

Entrances and clearances.	Number.	Freight.	Value.
Entrances:		<i>Tons.</i>	
Foreign.....	13	4,000	\$150,000
Domestic.....	13	1,000	35,000
Clearances:			
Foreign.....	9	3,500	100,000
Domestic.....	3	1,000	75,000
Freight.			
		1901.	1902.
Coal.....	tons.	8,900	8,900
Salt.....	do.	2,000	8,500
Lumber.....	do.	1,230	1,538
Lime and cement.....	do.	66	80
Brick.....	do.	113	135
Merchandise.....	do.	3,000	4,000
Miscellaneous.....	do.	1,000	1,000
		<u>16,419</u>	<u>24,211</u>

Amount of revenue collected during the fiscal year 1903, \$384.30.

C 9.

IMPROVEMENT OF HARBOR AT CHATHAM, MASSACHUSETTS.

This improvement having been completed with the completion of dredging November 9, 1901, by authority from the Chief of Engineers, United States Army, April 11, 1903, the unexpended balance, \$1,561.43, was on April 15, 1903, turned into the Treasury and the harbor is dropped from the list of works under improvement.

Money statement.

July 1, 1902, balance unexpended	\$1,561.43
June 30, 1903, amount expended during fiscal year (deposited to credit of United States Treasurer)	1,561.43

The dates and amounts of the appropriations for this harbor are as follows:

Act of—	
September 19, 1890	\$5,000.00
June 3, 1896	5,000.00
March 3, 1899	8,732.79
Total	18,732.79

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1902.

[Through the courtesy of the collector of customs, Barnstable, Mass.]

Freight.

	Tons.
Coal	1,200
Lumber	343
Merchandise	4,000
Total	5,543

C 10.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wrecks of the schooners Ira Laffrinier and Maud Briggs.

These wrecks, at Nauset Harbor, Massachusetts, were examined and found not to be dangerous obstructions to navigation.

Wreck of scow in Boston Harbor, Massachusetts.

This wreck was found to be a dangerous obstruction to navigation, about 900 feet from the Commonwealth docks, South Boston, but when a hoister was taken to the site to remove it it had drifted away and could not be found, although prolonged search was made for it both then and afterwards.

APPENDIX D.

IMPROVEMENT OF RIVERS AND HARBORS IN SOUTHEASTERN MASSACHUSETTS AND IN RHODE ISLAND.

*REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH OTHER
DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE,
MAJ. GEORGE W. GOETHALS AND CAPT. CASSIUS E. GILLETTE,
CORPS OF ENGINEERS.*

IMPROVEMENTS.

- | | |
|---|---|
| 1. Harbor of Refuge at Hyannis and Nantucket, Massachusetts. | 9. Fall River Harbor, Massachusetts. |
| 2. Vineyard Haven Harbor, Massachusetts. | 10. Newport Harbor, Rhode Island. |
| 3. Woods Hole Channel, Massachusetts. | 11. Harbor of Refuge at Point Judith, Rhode Island. |
| 4. New Bedford Harbor, Massachusetts. | 12. Entrance to Point Judith Pond, Rhode Island. |
| 5. Taunton River, Massachusetts. | 13. Harbor of Refuge at Block Island, Rhode Island. |
| 6. Sakonnet River, Rhode Island. | 14. Great Salt Pond, Block Island, Rhode Island. |
| 7. Pawtucket (Seekonk) River, Rhode Island. | 15. Removing sunken vessels or craft obstructing or endangering navigation. |
| 8. Providence River and Narragansett Bay and removal of Green Jacket Shoal, Providence River, Rhode Island. | |

HARBOR LINES.

- | | |
|--|---|
| 16. New Bedford Harbor, including Fairhaven and Acushnet River, Massachusetts. | 17. Pawtucket (Seekonk) and Providence rivers, Providence Harbor, Rhode Island. |
|--|---|

UNITED STATES ENGINEER OFFICE,
Newport, R. I., July 16, 1903.

GENERAL: In compliance with the provisions of G. O. No. 5, headquarters Corps of Engineers, U. S. Army, Washington, April 21, 1903, I have the honor to transmit herewith annual report on river and harbor works in the Newport, R. I., district for the fiscal year ending June 30, 1903.

Very respectfully,

CASSIUS E. GILLETTE,
Captain of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

D I.

IMPROVEMENT OF HARBORS AT HYANNIS AND NANTUCKET,
MASSACHUSETTS.

For history and projects see page 88 of this report.

Operations during the past fiscal year.—The river and harbor act of June 13, 1902, contained the following item: "Improving the harbors of Hyannis and Nantucket, Massachusetts: Continuing improvement and for maintenance and repairs, thirty-five thousand dollars."

Under date of July 30, 1902, the Secretary of War approved the allotment of \$20,000 of this appropriation to the improvement of Hyannis Harbor and \$15,000 to Nantucket Harbor.

(A) HYANNIS HARBOR.

The project for the expenditure of the funds available for this harbor contemplated extending the 15.5 feet deep anchorage area by dredging.

A contract for about \$18,000 worth of dredging was entered into with Charles H. Latham, of Hartford, Conn., under date of December 8, 1902, work to commence not later than April 1, 1903, extended to June 1, 1903, and later to June 15, 1903, and to be completed within six months of the time of commencement. Up to the close of the fiscal year the work had not been commenced.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to apply the available funds and additional appropriation recommended to the completion of the projected anchorage area.

Money statement.

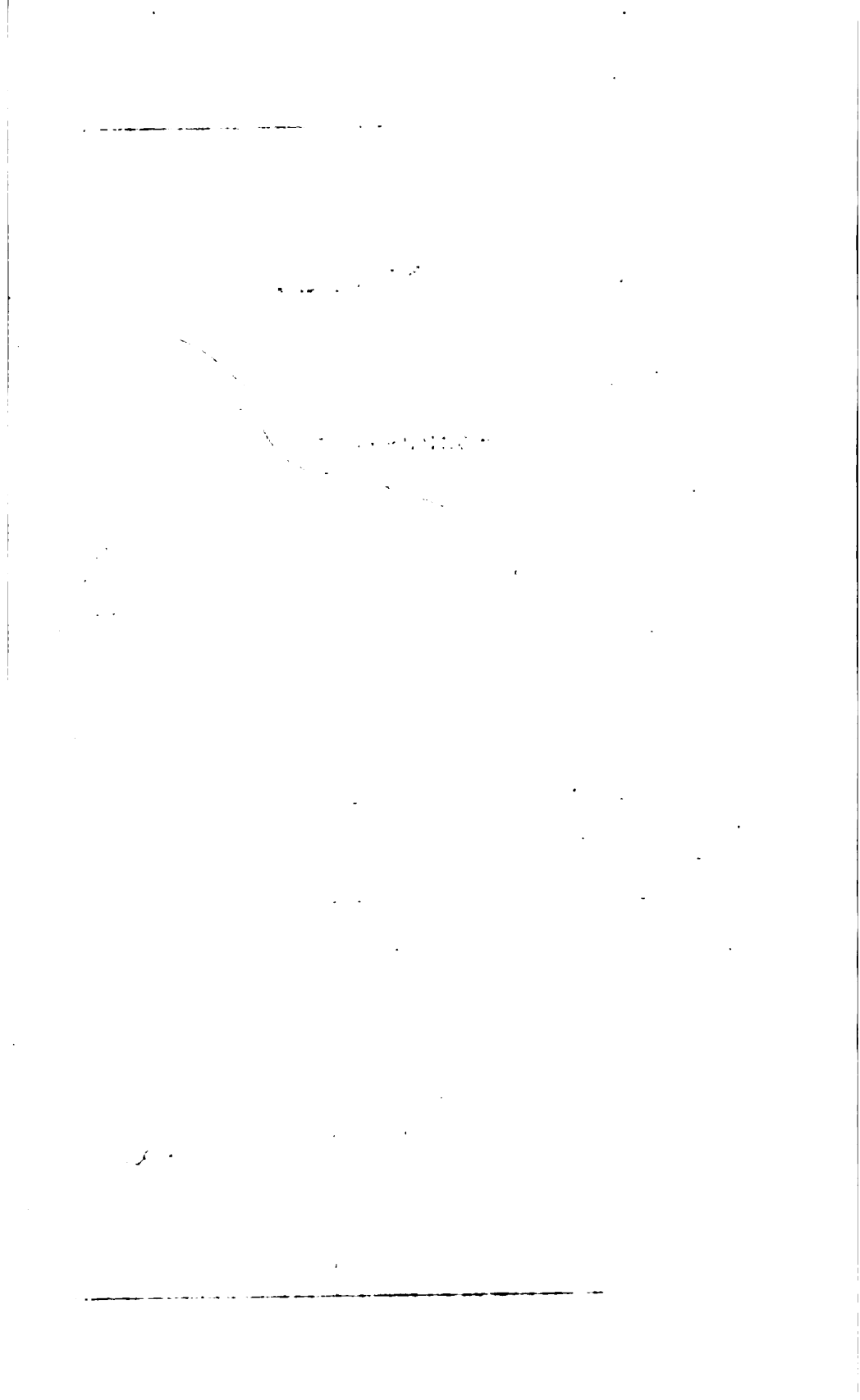
July 1, 1902, balance unexpended.....	\$21,861.11
June 30, 1903, amount expended during fiscal year.....	20.74
July 1, 1903, balance unexpended.....	21,840.37
July 1, 1903, amount covered by uncompleted contracts.....	18,000.00
Amount (estimated) required for completion of existing project.....	12,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	12,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

Previous projects.

March 2, 1827	\$10,650.00
April 30, 1830	6,517.83
March 2, 183	8,400.00
July 8, 1832 1	7,600.00
March 2, 1833	5,000.00
June 28, 1834	10,000.00
March 3, 1835	9,000.00
March 3, 1837	5,000.00
July 7, 1838	8,764.00
August 30, 1852	5,000.00
July 11, 1870	10,000.00
March 3, 1871	10,000.00
March 3, 1873	19,000.00
June 23, 1874	5,000.00
June 18, 1878	3,000.00
March 3, 1879	2,500.00
March 3, 1881	5,000.00
	\$123,431.83





Existing project.

August 5, 1886.....	\$10,000.00	
August 11, 1888.....	10,000.00	
September 19, 1890.....	8,000.00	
July 13, 1892.....	6,000.00	
August 18, 1894.....	3,500.00	
June 3, 1896.....	6,000.00	
March 8, 1899.....	2,162.00	
June 13, 1902 (allotment).....	20,000.00	
		\$65,662.00
Received from sale of material.....		20.68
Total.....		189,114.50

CONTRACT IN FORCE.

Date of approval: December 22, 1902.

Contractor: Charles H. Latham.

To commence April 1, 1903.

To complete in six months after commencement.

Rate: 19⁷/₁₀ cents per cubic yard.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Hyannis Harbor, Massachusetts, during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Messrs. T. Crocker & Sons, Hyannis, Mass.):

Commerce arriving at and leaving Hyannis Harbor, calendar year 1902.

	Tons.
Cotton and products.....	15
Tobacco.....	30
Grains and forage.....	2,000
Vegetables and truck.....	120
Live stock and products.....	40
Fish, oysters, etc.....	350
Lumber and products.....	5,600
Coal, minerals, etc.....	13,000
Fertilizers.....	25
General merchandise.....	1,300
Sundries.....	200
Total.....	22,680

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger.....	80	10	300
Freight mainly.....	18	11	400
Passenger mainly.....	50	9	400
Fishing.....	20	6	60
Tugs.....	300	11	90
Pleasure boats.....	225	7	60
Sail:			
Freight.....	300	12	400
Fishing boats.....	350	3	6
Oyster boats.....	12	4	8
Pleasure boats, large.....	75	8	60
Pleasure boats, small.....	230	3	8
Barges.....	75	14	500

(B) NANTUCKET HARBOR.

Operations during the past fiscal year.—The project for the expenditure of the funds available for this harbor contemplated dredging a channel 9 feet deep near the outer end of the jetties and the partial filling of the gap near the shore end of the east jetty.

Proposals were invited by public advertisement for the dredging, but none were received.

A contract was entered into under date of January 19, 1903, with E. S. Belden & Sons, of Hartford, Conn., for placing stone in the gap in the east jetty to the amount of about \$6,120, at the rate of \$2.97 per ton, the work to commence not later than May 1, 1903, and to be completed by July 8, 1903. At the close of the fiscal year the work had not yet been begun.

Operations contemplated for fiscal year ending June 30, 1904.—It is proposed to apply the available funds and additional appropriation recommended to filling the gap and then to building up the incomplete portions of the east jetty and to repairs to west jetty.

Money statement.

July 1, 1902, balance unexpended	\$15,000.00
June 30, 1903, amount expended during fiscal year	730.13
July 1, 1903, balance unexpended	14,269.87
July 1, 1903, outstanding liabilities	30.00
July 1, 1903, balance available	14,239.87
July 1, 1903, amount covered by uncompleted contracts	6,800.00
{ Amount (estimated) required for completion of existing project	100,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

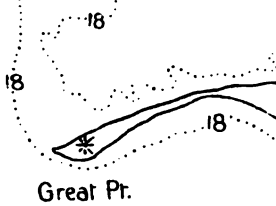
AMOUNTS APPROPRIATED.

Previous projects.

May 23, 1825, survey	\$300.00
March 2, 1829	30,000.00
March 2, 1831	8,265.00
July 3, 1832	6,000.00
June 14, 1844	1,169.75
	\$45,734.75

Existing project.

July 14, 1880	50,000.00
March 3, 1881	25,000.00
August 3, 1882	25,000.00
July 5, 1884	10,000.00
August 5, 1886	15,000.00
August 11, 1888	20,000.00
September 19, 1890	25,000.00
July 13, 1892	25,000.00
August 18, 1894	25,000.00
June 3, 1896	20,000.00
March 3, 1899	20,000.00
June 13, 1902 (allotment)	15,000.00
	275,000.00
Total	320,734.75

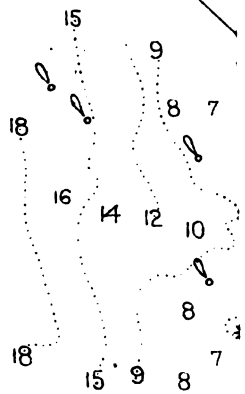


Great Pt.

OF REFUGE AT KET, MASS.



NANTUCKET S... refer to Mean Low Water.



Nantucker

Official

Casius E. F.

Captain of E.

P.B.'03.

CONTRACT IN FORCE.

Contractor: E. S. Belden & Sons.

Date of approval: February 28, 1903.

To commence May 1, 1903.

To complete in two working months after commencement.

Rate per ton of 2,000 pounds in place: \$2.97.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Nantucket Harbor, Massachusetts, during the calendar year ending December 31, 1902, is estimated as follows, based upon the best information obtainable:

Commerce arriving at and leaving Nantucket Harbor, calendar year 1902.

	Tons.
Tobacco	45
Rice	8
Grains and forage	2,000
Vegetables and truck	510
Live stock and products	40
Fish, oysters, etc.	800
Naval stores	6
Lumber and products	5,000
Coal, minerals, etc.	14,000
Fertilizers	125
Machinery	2,000
General merchandise	3,100
Sundries	656
Total	28,290

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average depth.	Average tonnage.
		<i>Feet.</i>	
Steam:			
Freight and passenger	500	8	500
Freight mainly	20	7	100
Passenger mainly	48	7	210
Fishing	7	5	6
Tugs	27	5	6
Pleasure boats	66	6	5
Sail:			
Freight	40	7	6
Fishing boats	70	4	5
Oyster boats	20	3	3
Pleasure boats, large	125	5	6
Pleasure boats, small	368	4	3

D 2.

IMPROVEMENT OF VINEYARD HAVEN HARBOR, MASSACHUSETTS.

For history and project see page 90 of this report.

Operations during the past fiscal year.—No works of improvement were in progress during the past fiscal year.

Operations contemplated for the fiscal year ending June 30, 1904.—Further work at this harbor is dependent upon the results of the examination of the Board of Engineers convened in accordance with the river and harbor act of June 13, 1902, to consider the general subject of harbors in the waters of this locality.

Money statement.

July 1, 1902, balance unexpended	\$4,612.65
July 1, 1903, balance unexpended	4,612.65

AMOUNTS APPROPRIATED.

Existing project.

April 11, 1888	\$25,000	June 8, 1896	\$7,000
September 19, 1890	10,000	March 3, 1899	3,000
July 8, 1892	7,500		
August 18, 1894	7,500	Total	60,000

COMMERCIAL STATISTICS.

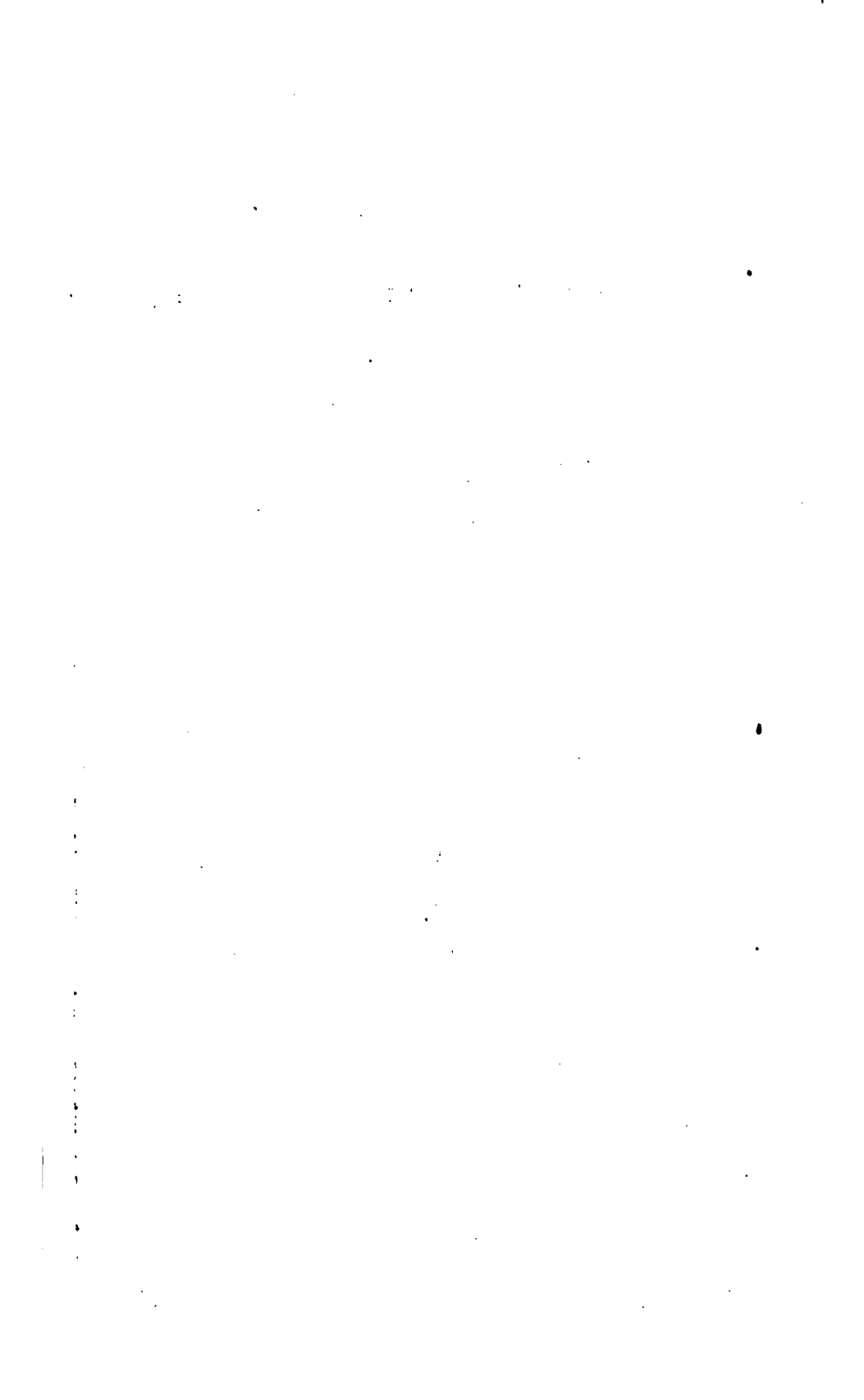
The commerce arriving at and leaving Vineyard Haven, Mass., during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. Lorenzo F. Luce, deputy collector of customs, Vineyard Haven, Mass.):

Commerce arriving at and leaving Vineyard Haven, calendar year 1902.

	Tons.
Cotton and products	200
Tobacco	40
Rice	50
Grains and forage	5,000
Vegetables and truck	100
Live stock and products	700
Fish, oysters, etc	3,500
Naval stores	15
Lumber and products	20,000
Coal, minerals, etc	200,000
Fertilizers	3,000
Machinery	90
General merchandise	12,000
Sundries	20,000
Total	254,695

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger	1,000	7	250
Freight mainly	5,000	17	1,500
Passenger mainly	12,000	7	250
Fishing	800	11	100
Tugs	1,000	13	200
Pleasure boats	1,000	4	30
Sail:			
Freight	3,000	19	1,400
Fishing boats	1,200	11	100
Pleasure boats, large	600	13	75
Pleasure boats, small	3,000	3	10
Barges	3,000	18	1,500



BUZZARDS BAY

E. L. LO, MASS.

NONAMESSET

12 15 18 20 22 24

hd

0 500

Deph

E. L. Lillie

Jan of Eng's, U.S.A.

PE:03.

ANDREW B. GRAMAM PHOTO-LITHO WASHINGTON, D.C.

Box 58

D 3.

IMPROVEMENT OF WOODS HOLE CHANNEL, MASSACHUSETTS.

For history and project see page 91 of this report.

Operations during the past fiscal year.—A contract was entered into under date of December 11, 1902, with R. G. Packard Company, of New York, for dredging and removing bowlders to the amount of about \$18,000, at the rate \$3.47 per cubic yard for all material other than bowlders exceeding 1 cubic yard; for which the price was \$10 per cubic yard; work to commence fifteen days after the approval of the contract and be completed within eight months. Owing to the difficulty of securing a coal supply during the winter the time of commencing the work was extended to May 15, 1903. The work of dredging commenced May 19, 1903, and up to the close of the fiscal year 4,341 cubic yards of clay, gravel, and small bowlders, and 42,272 cubic yards of bowlders exceeding 1 cubic yard each, were removed, nearly completing the contract. The main channel has been cleared of all obstructing shoals for its full width, excepting two small shoals on the northern edge of the channel near Devils Foot Island and the main shoal at the eastern end, through which a channel 225 feet wide has been dredged to the full projected depth of 13 feet at mean low water.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to apply the available funds to the completion of the contract now in force, the additional appropriation recommended to be expended in completing the full width and depth of the main channel and commencing the dredging in its southern branch.

Money statement.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	1,942.08
July 1, 1903, balance unexpended	18,057.92
July 1, 1903, outstanding liabilities	13,726.54
July 1, 1903, balance available	4,331.38
July 1, 1903, amount covered by uncompleted contracts	2,504.01
{ Amount (estimated) required for completion of existing project	336,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	150,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNTS APPROPRIATED.

August 30, 1852	\$3,500.00
March 3, 1879	15,000.00
August 2, 1882	52,000.00
July 5, 1884	25,000.00
August 5, 1886	14,500.00
March 2, 1895	5,000.00
June 3, 1896	20,000.00

794 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

March 3, 1899.....	\$20,000.00
June 13, 1902.....	20,000.00
Total.....	174,000.00
December 5, 1895, unexpended balance deposited to the credit of the Treasurer of the United States.....	400.08
Total.....	173,599.92

CONTRACT IN FORCE

Contractor: R. G. Packard Company.
Date of approval: January 8, 1903.
To commence in fifteen days after notification of approval of contract by Chief of Engineers.
To complete in eight months after commencement.
Rate: \$3.47 per cubic yard.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Woods Hole, Mass., by water during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. Walter O. Luscombe, of Woods Hole, Mass.):

Commerce arriving at and leaving Woods Hole, calendar year 1902.

	Tons.
Grains and forage.....	3,850
Vegetables and truck.....	27
Live stock and products.....	230
Fish, oysters, etc.....	330
Naval stores.....	44
Lumber and products.....	6,600
Coal, minerals, etc.....	6,600
Fertilizers.....	275
General merchandise.....	1,320
Total.....	19,266

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger.....	400	10	900
Freight mainly.....	100	7	25
Passengers mainly.....	200	11	50
Fishing.....	50	8	30
Tugs.....	40	10	100
Pleasure boats.....	100	10	100
Sail:			
Freight.....	100	8	150
Fishing boats.....	175	8	50
Pleasure boats, large.....	50	4	15
Pleasure boats, small.....	200	8	5

D 4.

IMPROVEMENT OF NEW BEDFORD HARBOR, MASSACHUSETTS.

For history and projects, see page 92 of this report.

Operations during the past fiscal year.—A contract was entered into under date of December 2, 1902, with Charles M. Cole, of Fall River, Mass., for dredging the remainder of the anchorage area in this harbor,

10

11

12

13

THE UNIVERSITY OF CHICAGO

and if funds remain after its completion for redredging any shoaling that may have occurred north of the bridge in the channel through the draw. Amount of contract, \$34,000, more or less. Time of commencement, January 16, 1903; time of completion, nine months after commencement; price of dredging, 19½ cents per cubic yard. The work of dredging was commenced December 19, 1902, and continued until March 13, 1903, during which time 45,124 cubic yards of mud, clay, and sand were removed from the anchorage area, adding about 4.6 acres to it. On March 13, 1903, the dredging plant was removed to Newport Harbor, in order that the dredging there might be completed before the summer crowding of that harbor began.

A map of a proposed harbor line for New Bedford Harbor was submitted under date of December 29, 1902, and approved March 8, 1903, by the Secretary of War.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to expend the available funds in completing the anchorage area and redredging portions of the draw channel. No further projects for work in this harbor have been approved. A survey was made and report thereon submitted June 24, 1899, with a view to further improvement in this harbor, but no action thereon has been taken by Congress. The report on this survey was printed as House Document No. 169, Fifty-sixth Congress, first session, and at page 1295, Annual Report of Chief of Engineers for 1900.

Money statement.

July 1, 1902, balance unexpended	\$37,700.00
June 30, 1903, amount expended during fiscal year	8,985.22
July 1, 1903, balance unexpended	28,764.78
July 1, 1903, outstanding liabilities	879.92
July 1, 1903, balance available	27,884.86
July 1, 1903, amount covered by uncompleted contracts	25,485.44

AMOUNTS APPROPRIATED.

July 4, 1836	\$10,000.00
March 3, 1875	10,000.00
August 14, 1876	10,000.00
August 11, 1888	10,000.00
September 19, 1890	10,000.00
July 13, 1892	7,500.00
August 18, 1894	7,500.00
June 3, 1896	10,000.00
March 3, 1899	44,000.00
June 13, 1902	37,700.00
Total	156,700.00
Received from sale of material	9.00
Total	156,709.00

CONTRACT IN FORCE.

Contractor: Charles M. Cole.

Date of approval: December 27, 1902.

To commence in twenty days after notification of approval by Chief of Engineers.

To complete in nine months after commencement.

Rate: 19½ cents per cubic yard.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving New Bedford, Mass., by water during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. George F. Bartlett, collector of customs, New Bedford, Mass.):

Commerce arriving at and leaving New Bedford, calendar year 1902.

	Tons.
Cotton and products	16,500
Tobacco	500
Grains and forage	15,500
Vegetables and truck	7,500
Live stock and products	500
Fish, oysters, etc.	8,500
Lumber and products	84,000
Coal, minerals, etc.	269,858
Fertilizers	3,500
General merchandise	95,000
Sundries	17,000
Total	468,408

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger	680	10	600
Freight mainly	400	15	1,000
Passenger mainly	500	8	60
Fishing	150	4	10
Tugs	450	10	50
Pleasure boats	100	10	150
Sail:			
Freight	750	12	1,100
Fishing boats	900	7	20
Pleasure boats, large	320	11	150
Pleasure boats, small	480	5	15
Barges	325	14	1,000

D 5.

IMPROVEMENT OF TAUNTON RIVER, MASSACHUSETTS.

For history and projects, see page 93 of this report.

Operations during the past fiscal year.—A contract was entered into under date of April 28, 1903, with Charles M. Cole, of Fall River, Mass., for dredging the shoals that had formed in the previously dredged channel near Dighton wharf and below Wickamont. Amount of contract, \$5,000, less expenses of supervision and contingencies. Price for dredging, 88 cents per cubic yard. Time of commencement, May 15; completion, July 15, 1903. Dredging was commenced May 19 and completed July 3, 1903. The entire shoal near Dighton wharf and the greater portion of the shoal below Wickamont were removed.

Operations contemplated for the fiscal year ending June 30, 1904.—As appropriations become available it is proposed to dredge the shoals offering the greatest obstructions to navigation.

TAUNTON RIVER, MASS.

BERKLEY BRIDGE - DIGHTON.

100 0 200 400 600 800 1000 FT.

Depths refer to Mean High Water.

Official

Osborne E. Gillette

Captain of Eng'rs, U.S.A.

The Nook

B.M.

Wikamount

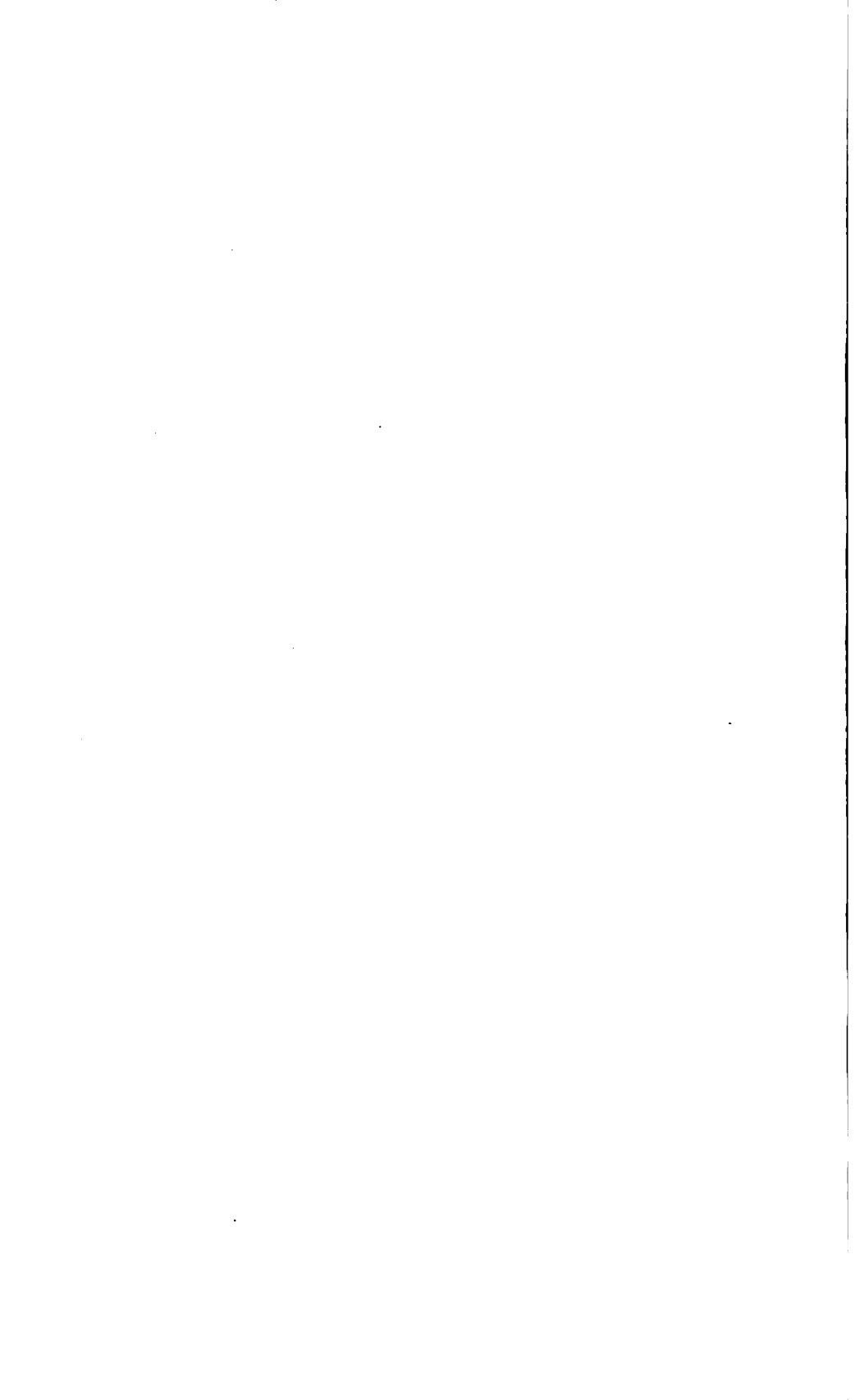
Churchs Whf.

PROPOSED DREDGING

R.R.

P.B.'03.

ANDREWS & COMPANY PHOTO-LITHO WASHINGTON, D.C.



Money statement.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	1,278.74
July 1, 1903, balance unexpended	3,721.26
July 1, 1903, outstanding liabilities	3,050.86
July 1, 1903, balance available	670.40
July 1, 1903, amount covered by uncompleted contracts	416.80
{ Amount (estimated) required for completion of existing project	5,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

AMOUNTS APPROPRIATED.

Previous projects.

July 11, 1870	\$10,000
March 3, 1871	10,000
June 10, 1872	10,000
March 3, 1873	10,000
June 23, 1874	10,000
March 3, 1875	10,000
June 18, 1878	2,000
March 3, 1879	1,000
	<u>\$63,000</u>

Present project.

July 14, 1880	\$17,500
March 3, 1881	25,000
August 2, 1882	25,000
July 5, 1884	28,500
September 19, 1890	7,000
July 3, 1892	7,000
August 18, 1894	5,000
June 3, 1896	5,000
March 3, 1899	7,000
June 13, 1902	5,000
	<u>130,000</u>
Total	193,000

CONTRACT (EMERGENCY) IN FORCE.

Contractor: Charles M. Cole.

To commence in fifteen days after notification of acceptance of bid.

To complete in two months after commencement.

Rate: 88 cents cubic yard.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Taunton River, Massachusetts, by water during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from the Staples Coal Company, Taunton, Mass.).

Commerce arriving at and leaving Taunton River, calendar year 1902.

	Tons.
Cotton and products	5,500
Grains and forage	40,000
Lumber and products	25,000
Coal, minerals, and products	500,000
General merchandise	3,000
Sundries	14,000
Fish, oysters, etc	100
Total	587,600

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Fect.</i>	
Steam:			
Tugs	800	7	50
Pleasure boats	150	4	12
Sail:			
Freight	700	9	30
Fishing boats	75	7	90
Pleasure boats, small	300	4	10
Barges	900	9	90

D 6.

IMPROVEMENT OF SAKONNET RIVER, RHODE ISLAND.

For history and project, see page 94 of this report.

Operations during the past fiscal year.—No work has been done and no funds expended during the past fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$40,000.00
July 1, 1903, balance unexpended	40,000.00

AMOUNTS APPROPRIATED.

June 3, 1896	\$20,000.00
March 3, 1899	20,000.00
Total	40,000.00

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Sakonnet River, Rhode Island, during the calendar year ending December 31, 1902, is estimated as follows (based upon reports received from Mr. J. A. Pettay, general manager of the Sakonnet Steamboat Company):

Commerce arriving at and leaving Sakonnet River, calendar year 1902.

	Tons.
Cotton and products	7
Tobacco	6
Rice	8
Grains and forage	7,560
Vegetables and truck	790
Live stock and products	170
Fish, oysters, etc	42,570
Lumber and products	1,630
Coal, minerals, etc	12,722
Fertilizers	14,780
Machinery	27
General merchandise	1,731
Sundries	34
Fish oil	4,500
Total	86,530

New transportation company established during the year: Freight steamer *F. M. Shaw* to Fall River, Mass.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger	1,240	8	150
Freight, mainly	400	7	250
Passenger, mainly	700	8	150
Fishing	840	11	250
Tugs	27	9	75
Pleasure boats	486	5	10
Sail:			
Freight	81	15	400
Fishing boats	68	9	25
Oyster boats	5	5	15
Pleasure boats, large	41	7	30
Pleasure boats, small	1,960	4	4
Barges	9	16	400

D 7.

IMPROVEMENT OF PAWTUCKET (SEEKONK) RIVER, RHODE ISLAND.

For history and projects, see page 95 of this report.

Operations during the past fiscal year.—A contract was entered into under date of December 2, 1902, with J. S. Packard Dredging Company, of Providence, R. I., for completing the new 12-foot deep channel 100 feet wide between Ten-mile River and Bucklins Island and redredging portions of the old channel where it has shoaled. Amount of contract, \$25,000, more or less; price, 24.9 cents per cubic yard. Time of commencement, January 3, 1903; completion within eight months after commencement.

The work of dredging was commenced December 8, 1902, and was continued only two days, when by the sudden freezing of the river the plant was compelled to withdraw. The work has not been resumed thus far during the season of 1903. For about four weeks the dredge was engaged on the work of Newport Harbor.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to use the available balances in completing the unfinished portion of the channel between Ten-mile River and Bucklins Island and redredging portions of the channel which have shoaled.

Money statement.

July 1, 1902, balance unexpended.....	\$28,500.00
June 30, 1903, amount expended during fiscal year	339.38
July 1, 1903, balance unexpended.....	28,160.62
July 1, 1903, outstanding liabilities	254.48
July 1, 1903, balance available	27,906.14
July 1, 1903, amount covered by uncompleted contracts.....	24,745.53

AMOUNTS APPROPRIATED.

March 2, 1867.....	\$17,000.00
July 11, 1870.....	8,000.00
March 3, 1871.....	7,000.00
June 10, 1872.....	10,000.00
March 3, 1873.....	10,000.00
July 5, 1884.....	50,000.00
August 5, 1886.....	30,000.00
August 11, 1888.....	35,000.00
September 19, 1890.....	30,000.00
July 13, 1892.....	35,000.00
August 18, 1894.....	25,000.00
June 3, 1896.....	20,500.00
March 3, 1899.....	30,000.00
June 13, 1902.....	28,500.00
Total.....	336,000.00
Received from sale of material	19.59
Total.....	336,019.59

CONTRACT IN FORCE.

Contractor: J. S. Packard Dredging Company.

Date of approval: December 19, 1902.

To commence in fifteen days after notification of approval by the Chief of Engineers.

To complete in eight months after commencement.

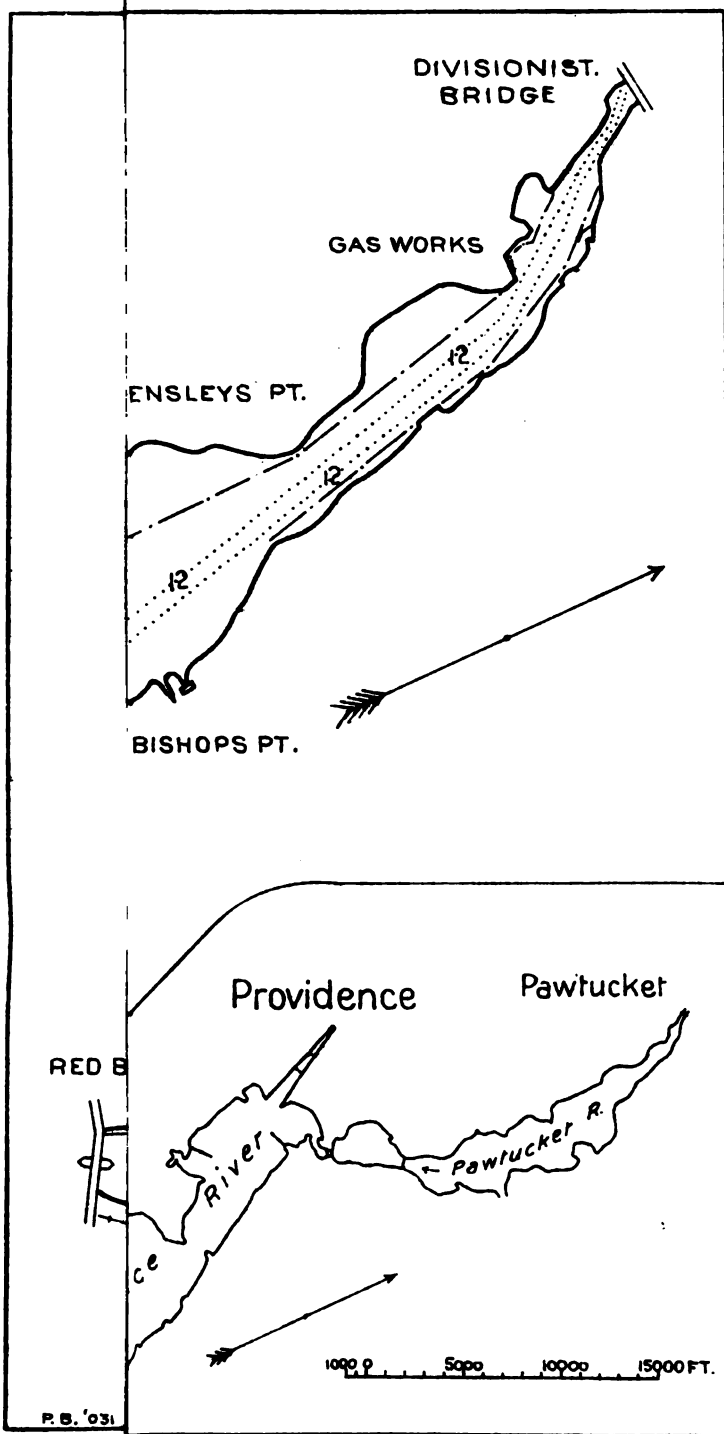
Rate: 24.9 per cents cubic yard.

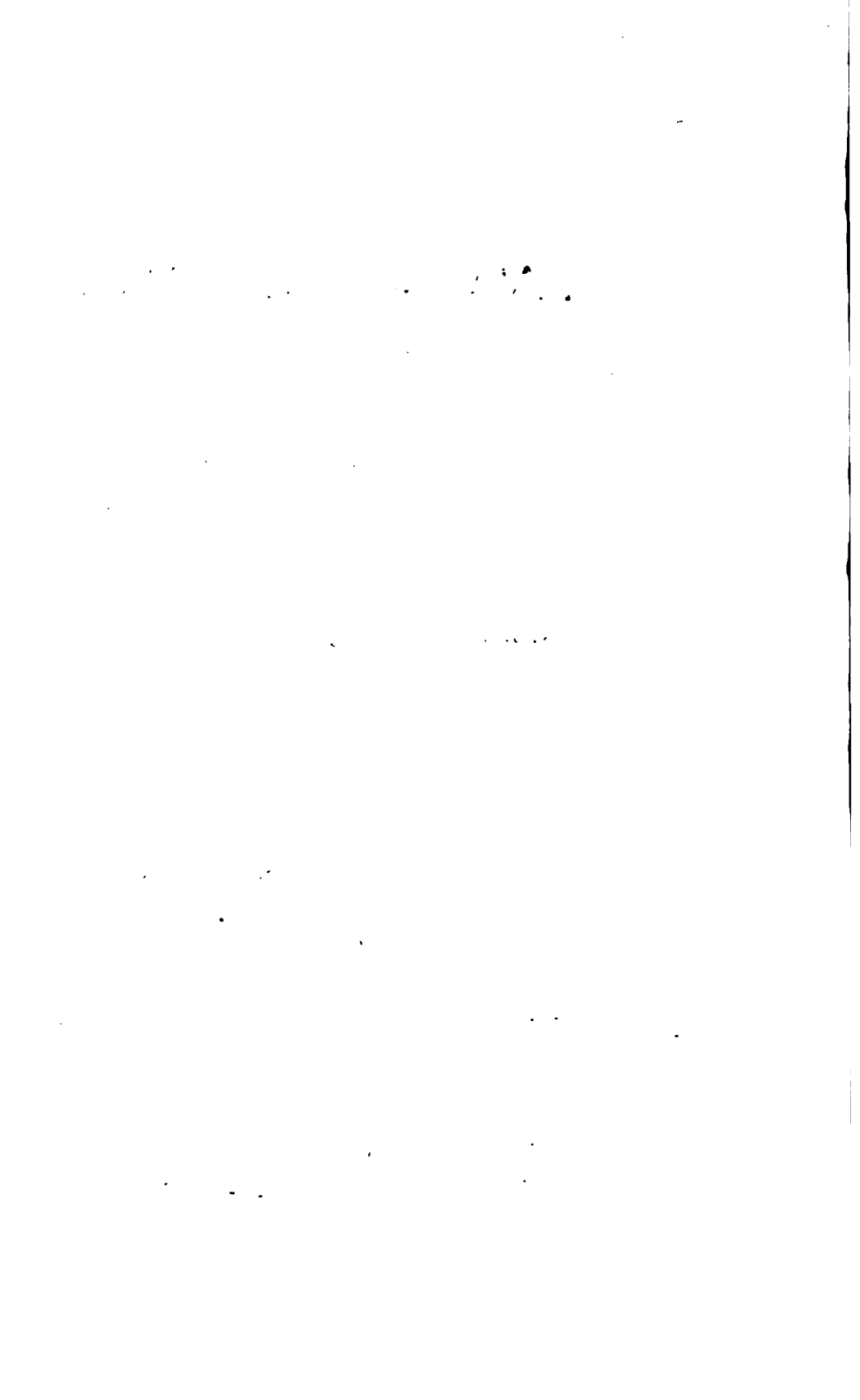
COMMERCIAL STATISTICS.

The commerce arriving at and leaving Pawtucket River, Rhode Island, during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from the Newell Coal and Lumber Company, of Pawtucket, R. I.):

Commerce arriving at and leaving Pawtucket River, calendar year 1902.

	Total
Lumber, and products	9,000
Coal, minerals, etc.....	200,000
Fertilizers.....	600
General merchandise	7,500
Sundries	7,500
Total.....	224,600





The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight mainly	300	10	500
Passenger mainly	350	8	100
Tugs	750	5	50
Sail:			
Freight	250	10	300
Pleasure boats, large	30	7	100
Pleasure boats, small	400	8	4
Barges	175	10	500

D 8.

IMPROVEMENT OF PROVIDENCE RIVER AND NARRAGANSETT BAY,
AND REMOVAL OF GREEN JACKET SHOAL, RHODE ISLAND.

(A) PROVIDENCE RIVER AND NARRAGANSETT BAY.

For history and projects see page 95 of this report.

Operations during the past fiscal year.—At the beginning of the fiscal year work was in progress on the new channel, 400 feet wide and 25 feet deep, through the "western passage" of Narragansett Bay, and was continued until September 30, 1902, when it was completed, 298,565 cubic yards having been dredged during the fiscal year, making the total amount of dredging under the project for this channel 3,135,205 cubic yards.

Under date of March 4, 1903, a contract was entered into with the International Contracting Company, of New York, for dredging the anchorage area in Providence Harbor to 25 feet depth at mean low water, under the project of 1902. Amount of contract, \$100,000, less expenses of supervision and contingencies. Time of commencement, April 24, 1903; time of completion, July 24, 1904; price per cubic yard, 12½ cents.

Work of dredging was commenced April 29, 1903, in the upper part of the harbor, covering that part known as Green Jacket shoal and the adjacent part of the harbor, and continued through the fiscal year; 301,027 cubic yards of mud were dredged.

A map of a proposed harbor line for Providence Harbor was submitted under date of December 23, 1902, and approved under date of March 30, 1903, by the Secretary of War.

Operations contemplated during the fiscal year ending June 30, 1904.—It is proposed to apply the available balance and the appropriation recommended to enlarging the 25 feet deep anchorage area in Providence Harbor.

Money statement.

July 1, 1902, balance unexpended	\$207,625.53
June 30, 1903, amount expended during fiscal year	106,620.77
July 1, 1903, balance unexpended	101,004.76
July 1, 1903, outstanding liabilities	28,945.77
July 1, 1903, balance available	72,058.99
July 1, 1903, amount covered by uncompleted contracts	52,871.62
{ Amount (estimated) required for completion of existing project.	507,777.50
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	200,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

August 30, 1852.....	\$5,000.00
August 30, 1852, survey.....	1,500.00
May 2, 1867.....	25,000.00
May 11, 1870.....	5,000.00
July 15, 1870.....	2,500.00
June 10, 1872.....	10,000.00
March 3, 1873.....	10,000.00
March 18, 1878.....	5,000.00
June 18, 1878.....	50,000.00
March 3, 1879.....	60,000.00
July 14, 1880.....	60,000.00
March 3, 1881.....	60,000.00
August 2, 1882.....	125,000.00
July 5, 1884.....	85,000.00
August 5, 1886.....	30,000.00
August 11, 1888.....	40,000.00
September 19, 1890.....	50,000.00
July 13, 1892.....	50,000.00
August 18, 1894.....	17,500.00
June 3, 1896.....	25,000.00
June 4, 1897.....	125,000.00
July 1, 1898.....	125,000.00
March 3, 1899.....	10,000.00
June 6, 1900.....	54,489.00
March 3, 1901.....	59,000.00
June 13, 1902.....	100,000.00
June 28, 1902.....	84,560.00
Total.....	1,274,549.00
Received from sale of material.....	148.39
Total.....	1,274,692.39

CONTRACTS IN FORCE.

Contractor: The International Contracting Company.

Dates of approval: March 27, 1901, and March 21, 1903.

To commence: April 1, 1901, and in thirty days after notification of approval by Chief of Engineers, respectively.

To complete: October 1, 1903, and in fifteen months after commencement, respectively.

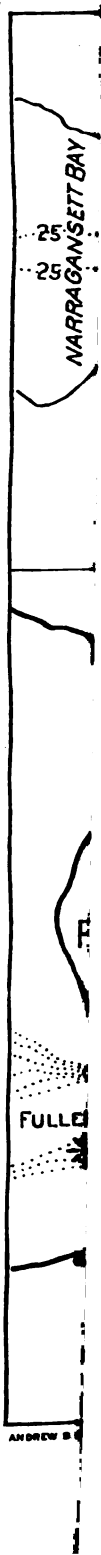
Rates: 16.4 and 12½ cents per cubic yard, respectively.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Providence River, Rhode Island, by water, during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from the harbor master and other citizens of Providence, R. I.):

Commerce arriving at and leaving Providence River, calendar year 1902.

	Tons.
Lumber and products.....	43,000
Coal, minerals, etc.....	1,500,000
Oil, naphtha, etc.....	15,000
General merchandise.....	16,000
Sundries.....	800,000
Bricks.....	5,000
Total.....	2,379,000



17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

17.2.44 10.11.1944

1874

1874

During the year a new line of fruit steamers, the Verly Line, was established for commerce with the South, making 41 trips and bringing 680,000 bunches of bananas.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger	725	12	600
Freight mainly	350	18	1,450
Passenger mainly	3,600	7	519
Fishing	1,450	3	30
Tugs	1,550	13	100
Pleasure boats	1,550	5	30
Sail:			
Freight	900	18	1,500
Pleasure boats, large	450	7	40
Pleasure boats, small	1,550	3	7
Barges	1,750	16	1,200

(B) GREEN JACKET SHOAL.

For history and projects, see page 96 of this report.

Operations during the past fiscal year.—The remaining portions of the shoal are being removed under the project for enlarging the 25-foot deep anchorage area in Providence Harbor.

Money statement.

July 1, 1902, balance unexpended	\$114.42
July 1, 1903, balance unexpended	114.42
July 1, 1903, outstanding liabilities	114.42

AMOUNTS APPROPRIATED.

Present project.

August 5, 1886	\$26,250
August 11, 1888	28,000
September 19, 1890	25,000
July 13, 1892	10,000
August 18, 1894	7,500
June 3, 1896	7,500
Total	104,250

COMMERCIAL STATISTICS.

For the commercial statistics, see report of improvements of Providence River and Narragansett Bay, and Providence Harbor, Rhode Island.

D 9.

IMPROVEMENT OF FALL RIVER HARBOR, MASSACHUSETTS.

For history and project, see page 97 of this report.

Operations during the past fiscal year.—A continuing contract was entered into under date of December 2, 1902, with J. S. Packard Dredging Company, of Providence, R. I., for dredging the projected

channel 300 feet wide and 25 feet deep at mean low tide in front of the city and across the flats in Mount Hope Bay to the deep water of Naragansett Bay. Amount of contract, about 1,081,000 cubic yards. Price 13.1 cents per cubic yard. Time of commencement, December 26, 1902; completion, June 26, 1904. The work of dredging was commenced December 12, 1902, and continued through the remainder of the fiscal year except for about two months during the winter; 293,235 cubic yards of material were removed. Work was in progress at the close of the fiscal year.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to continue the dredging of the new channel, completing the portion along the city front.

Money statement.

July 1, 1902, balance unexpended	\$38,000.00
Amount appropriated by sundry civil act approved March 3, 1903	117,412.00
	155,412.00
June 30, 1903, amount expended during fiscal year	17,551.00
July 1, 1903, balance unexpended	137,860.91
July 1, 1903, outstanding liabilities	22,410.91
July 1, 1903, balance available	115,450.00
July 1, 1903, amount covered by uncompleted contracts	101,904.06

AMOUNTS APPROPRIATED.

Previous projects.

June 23, 1874	\$10,000
March 3, 1875	10,000
August 14, 1876	10,000
	\$30,000

Existing project.

March 3, 1899	20,000
June 3, 1902	88,000
March 3, 1903	117,412
	175,412
Total	305,412

CONTRACT IN FORCE.

Contractor: J. S. Packard Dredging Company.

Date of approval: December 11, 1902.

To commence in fifteen days after notification of approval by Chief of Engineers (based mainly upon reports received from Mr. James Brady, collector of customs,

and other citizens of Fall River):

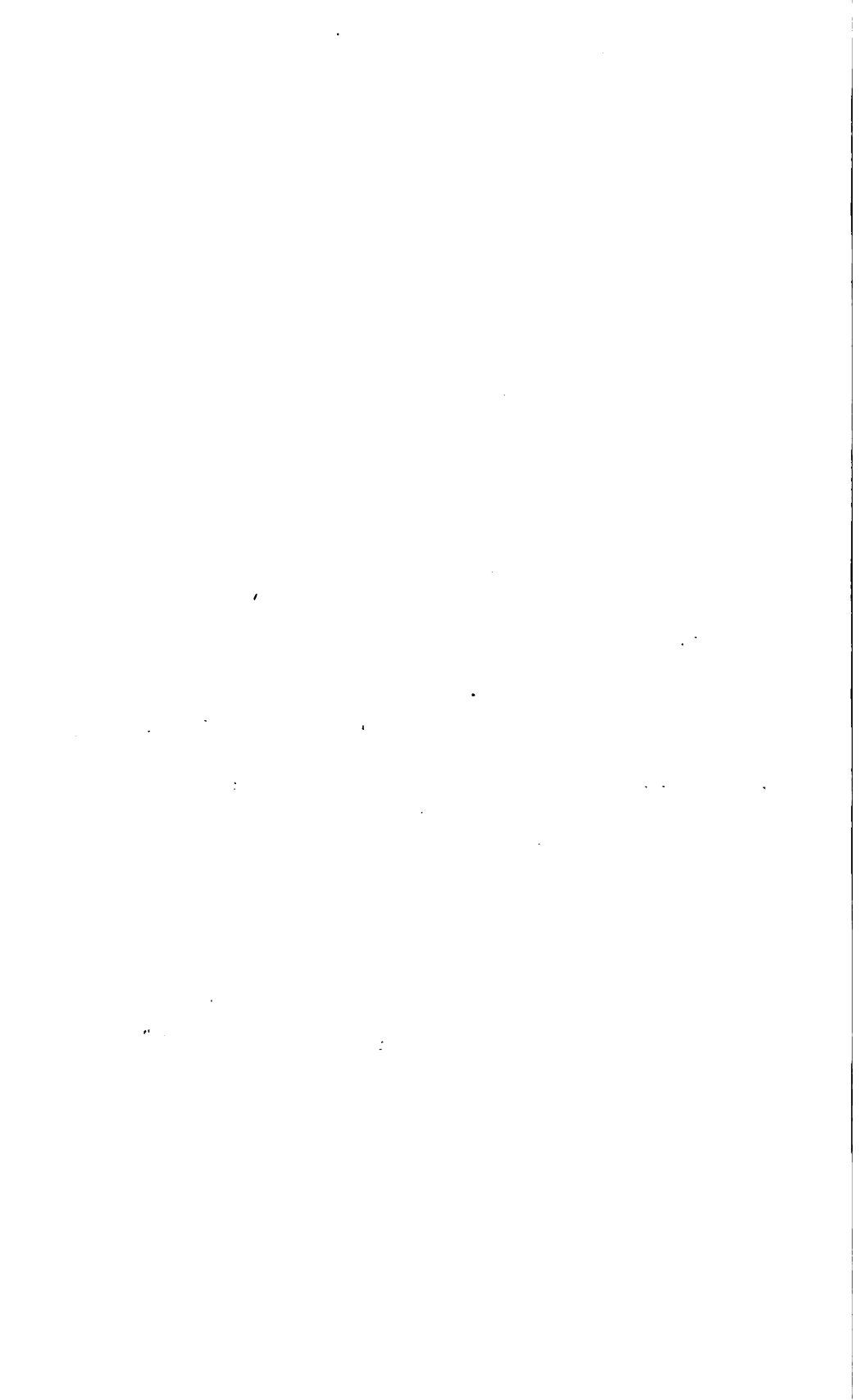
COMMERCIAL STATISTICS.

The commerce arriving at and leaving Fall River Harbor, Massachusetts, by water during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. James Brady, collector of customs, and other citizens of Fall River):

BOF

Low Wa





Commerce arriving at and leaving Fall River Harbor, calendar year 1902.

	Tons.
Cotton and products	200,000
Lumber and products	115,000
Coal, minerals, etc.	600,000
General merchandise	2,500,000
Total	3,415,000

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger	800	12	2,800
Freight mainly	550	10	1,500
Passenger mainly	900	8	500
Tugs	450	7	85
Pleasure boats	400	7	100
Sail:			
Freight	450	10	175
Pleasure boats, large	325	6	11
Pleasure boats, small	1,850	3	3
Barges	700	12	500

D 10.

IMPROVEMENT OF NEWPORT HARBOR, RHODE ISLAND.

For history and projects, see page 98 of this report.

Operations during the past fiscal year.—A contract was entered into, under date of March 2, 1903, with Charles M. Cole, of Fall River, Mass., for dredging the shoal places remaining in the harbor and removing bowlders. Amount of contract, \$35,000, less the expenses of supervision and contingencies. Price, 32 cents per cubic yard for dredging and \$18 per cubic yard for certain bowlders. Time of commencement, April 1, 1903; completion, October 1, 1903.

The work of dredging commenced March 15, 1903, and up to the close of the fiscal year the contractor had removed 90,445 cubic yards of mud, clay, etc., and 10.76 cubic yards of bowlders exceeding one cubic yard each that were found in the material dredged. At that date the contract had been practically completed.

The completion of this contract completes all existing projects for the improvement of Newport Harbor.

Under date of April 28, 1903, the map of a survey of this harbor, together with a report thereon and an estimate of the cost of a channel through the harbor 18 feet deep, was submitted to the Chief of Engineers.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to complete the work in progress at the beginning of the fiscal year.

Further work awaits the action of Congress on the new project submitted.

Money statement.

July 1, 1902, balance unexpended.....	\$39,750.00
June 30, 1903, amount expended during fiscal year.....	^a 19,392.95
July 1, 1903, balance unexpended.....	20,357.05
July 1, 1903, outstanding liabilities.....	13,202.02
July 1, 1903, balance available	7,155.03
July 1, 1903, amount covered by uncompleted contracts.....	427.42

AMOUNTS APPROPRIATED.

March 3, 1873.....	\$3,500.00
June 23, 1874.....	10,000.00
March 3, 1875.....	10,000.00
March 3, 1881.....	25,000.00
August 2, 1882.....	20,000.00
July 5, 1884.....	20,000.00
August 5, 1886.....	15,000.00
August 11, 1888.....	12,000.00
September 19, 1890.....	12,500.00
July 13, 1892.....	25,000.00
August 18, 1894.....	7,500.00
June 3, 1896.....	15,000.00
March 3, 1899.....	15,000.00
August 29, 1901.....	50.00
June 2, 1902.....	750.00
June 13, 1902.....	39,000.00
Received from sale of material.....	8.32
Total.....	235,308.32
Amount returned to Treasury of the United States.....	430.46
Total.....	234,888.86

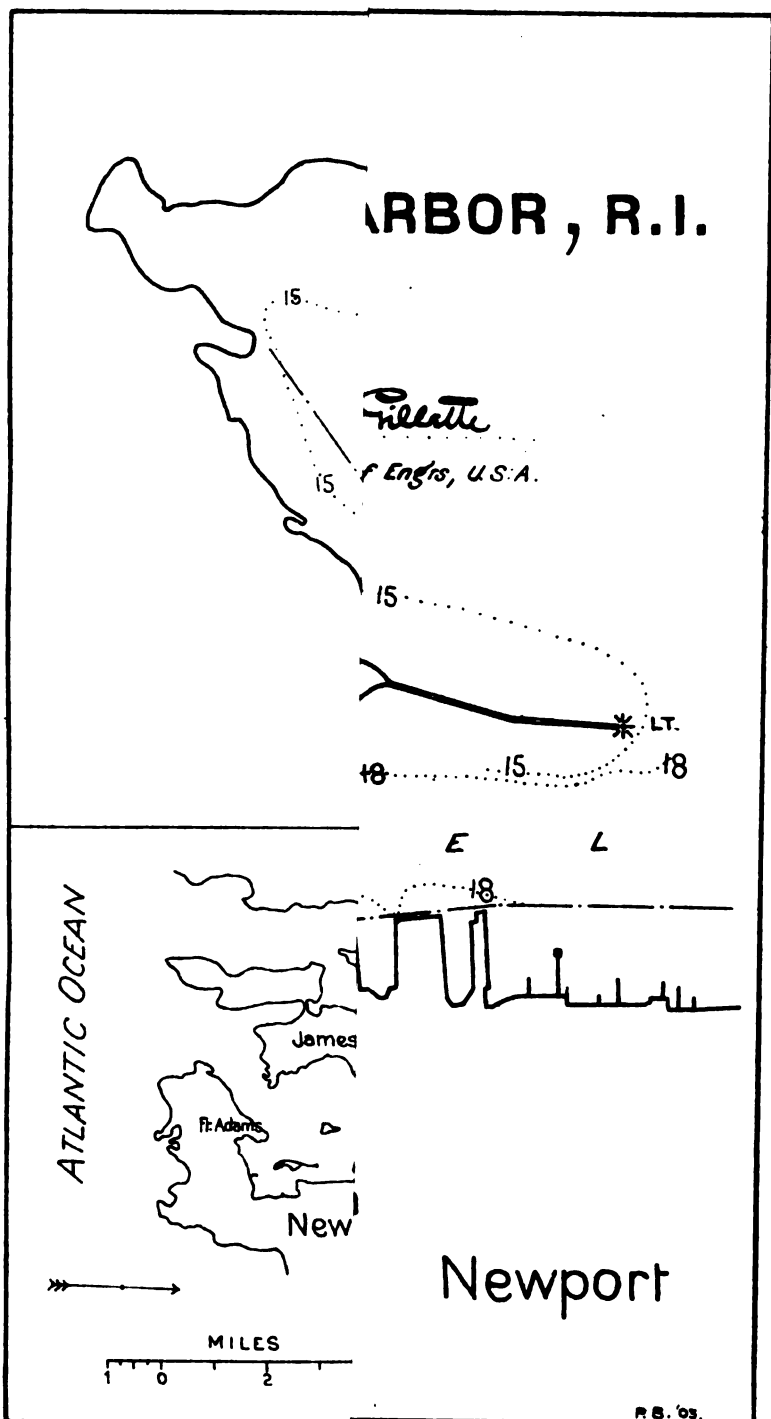
CONTRACT IN FORCE.

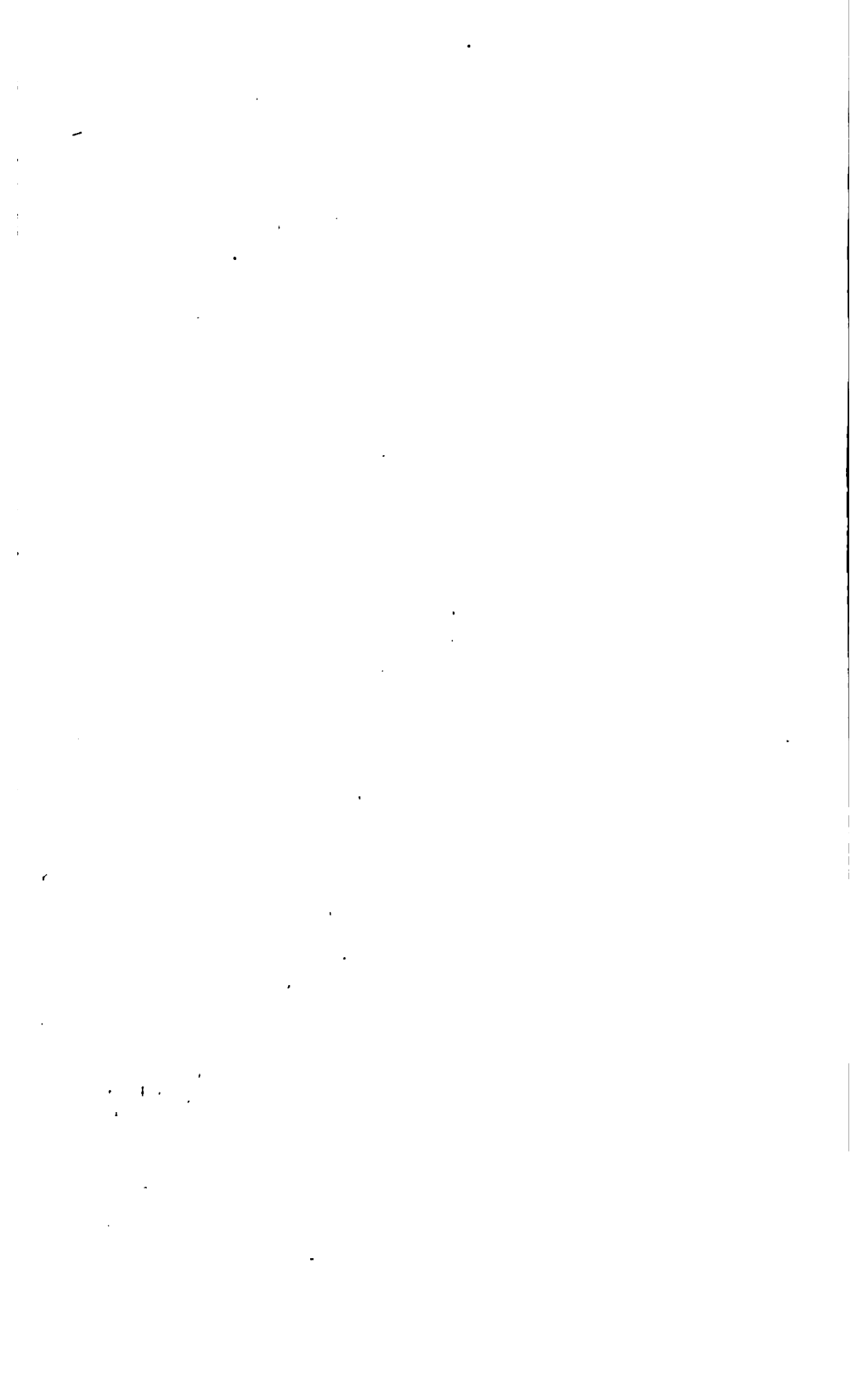
Contractor: Charles M. Cole.
 Date of approval: March 21, 1903.
 To commence in fifteen days after notification of approval by Chief of Engineers.
 To complete in six working months after commencement.
 Rates: 32 cents per cubic yard for dredging and \$18 per cubic yard for removing large bowlders.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Newport Harbor, Rhode Island, during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. Clarence A. Hammett, collector of customs, and other citizens of Newport, R. I.):

^a Returned to Treasury United States, \$408.33.





Commerce arriving at and leaving Newport Harbor, calendar year 1902.

	Tons.
Cotton, and products.....	145
Tobacco.....	50
Grains and forage.....	2,250
Vegetables and truck.....	1,200
Fish, oysters, etc.....	141,000
Naval stores.....	1,500
Lumber, and products.....	40,000
Coal, minerals, etc.....	70,000
Fertilizers.....	1,500
Machinery.....	1,000
General merchandise.....	80,000
Sundries.....	25,000
Total.....	363,595

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger.....	1,500	12	2,050
Freight, mainly.....	430	10	1,200
Passenger, mainly.....	4,200	9	600
Fishing.....	700	9	200
Tugs.....	880	9	97
Pleasure boats.....	1,500	7	125
Sail:			
Freight.....	920	10	180
Fishing boats.....	920	6	30
Pleasure boats, large.....	1,900	6	15
Pleasure boats, small.....	3,500	3	4
Barges.....	400	12	650

D II.

HARBOR OF REFUGE AT POINT JUDITH, RHODE ISLAND.

For history and project, see page 99 of this report.

Operations during the past fiscal year.—The project for the expenditure of the \$100,000 appropriated by the river and harbor act of June 13, 1902, provides for building a portion of the shore arm of the easterly detached breakwater. A contract was entered into under date of February 18, 1903, with John F. Donovan, of New York, for constructing as much of the shore end of this breakwater as the available funds would pay for. Amount of contract, \$100,000, less the expenses of supervision and contingencies. Time of commencement, April 1, 1903; completion, July 1, 1904; price, \$2.75 per ton of stone. Preparations were made at the quarry at Sachem Head, Conn., for shipping stone, but owing to long-continued bad weather no stone was sent to the breakwater until June 25, 1903, where it remained until after the close of the fiscal year before the weather would admit of unloading at the work.

Under date of September 26, 1902, the Board of Engineers, considering the subject of harbors of refuge in this locality, submitted a report on this harbor to the Chief of Engineers. The report is printed herewith.

During the year 3 small lights were maintained on the breakwater by the Engineer Department.

During the year 24 steamers, 13 barges, 219 schooners, and 161 sloops made use of the harbor.

Operations contemplated for the fiscal year ending June 30, 1904.—
Building about 650 feet of the shore end of the easterly breakwater.

Money statement.

July 1, 1902, balance unexpended	\$103,290.62
June 30, 1903, amount expended during fiscal year	2,881.32
July 1, 1903, balance unexpended	100,339.30
July 1, 1903, outstanding liabilities	129.82
July 1, 1903, balance available	100,209.48
July 1, 1903, amount covered by uncompleted contracts	90,000.00
{ Amount (estimated) required for completion of existing project	844,310.98
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	844,310.98
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

September 19, 1890	\$75,000.00
July 13, 1892	75,000.00
March 3, 1893	100,000.00
August 18, 1894	100,000.00
March 2, 1895	800,000.00
June 11, 1896	800,000.00
June 4, 1897	800,000.00
June 13, 1902	100,000.00
Total	1,350,000.00
Received from sale of material	38.61
Total	1,350,038.61

CONTRACT IN FORCE.

Contractor: John F. Donovan.

Date of approval, March 16, 1903.

To commence not later than April 1, 1903.

To complete in fifteen working months after commencement.

Rate: \$2.75 per ton of 2,000 pounds in place.

COMMERCIAL STATISTICS.

The tonnage of vessels passing Point Judith, R. I., during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. Asa Church, keeper Point Judith life-saving station, Rhode Island, in gross tons):

Tonnage of vessels passing Point Judith, calendar year 1902.

	Gross tons.
Steamers (freight, fish, and passenger)	9,100,000
Yachts (steam and sail)	1,400,000
Schooners (two to six masts)	82,000,000
Ships, barks, brigs, barkentines, etc	250,000
Sloops	50,000
Barges	7,700,000
Total	50,500,000

PORT OF REFUGE AT JUDITH, R.I.

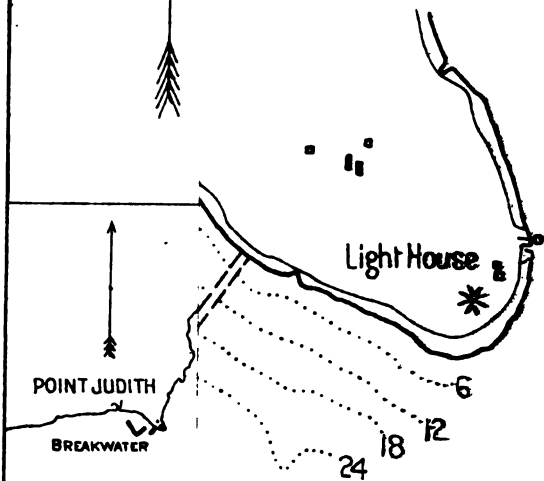
SCALE

2000 3000 4000 FT.

ial

Cassius E. Filleau

Captain of Eng'rs, U.S.A.



Block Island

Sound



1 0

BLOCK ISLAND

Depths refer to Mean Low Water.

P. B. '03.

ANDREW B. GRAHAM, PHOTO LITHO W.

REPORT OF BOARD OF ENGINEERS ON IMPROVEMENT OF POINT JUDITH
HARBOR OF REFUGE, RHODE ISLAND.UNITED STATES ENGINEER OFFICE,
Newport, R. I., September 16, 1902.

GENERAL: The Board of Engineers constituted by paragraph 3, Special Orders, No. 19, current series, Headquarters, Corps of Engineers, having examined the harbor of refuge at Point Judith, R. I., the adjacent shores, and the facilities of the life-saving station at that locality for launching its boats, has the honor to submit the following report in compliance with instructions contained in Department letter of July 11, 1902:

Under the requirements of the river and harbor act of August 11, 1888, a survey was made of the "coast near life-saving station, East Point Judith, R. I., with a view to constructing a breakwater." As a result of this survey the present harbor of refuge was recommended. The reasons governing the selection of the locality are set forth in Executive Document No. 66, Fifty-first Congress, first session.

The harbor was to be formed by a V-shaped breakwater, as indicated on the accompanying drawing,^a and a detached breakwater to cover the gap between the extremity of the eastern arm and the mainland, as indicated. The total cost was estimated at \$1,250,000 on the supposition that stone would cost not to exceed \$1 per ton. The cross section of the breakwater was to be 20 feet on top, with side slopes on the unexposed face of 1 on 1, and on the exposed face of 1 on 2 down to a depth of 12 feet, and of 1 on 1 below this depth. The top of the breakwater was to be 10 feet above mean low water.

In 1892 Congress placed this work under the continuing-contract system. The contract price for stone in place was \$1.27½ per ton, or over 25 per cent in excess of the estimated cost. In September, 1896, a heavy gale, accompanied by an abnormally high tide, did considerable damage to the breakwater, in consequence of which a Board of Engineers was convened to consider the construction. This Board reported in favor of completing the main breakwater, of raising the eastern arm—the one most exposed to severe gales—3 feet, or to a height of 13 feet above mean low water, thereby strengthening it at the same time, and of deferring "the construction of the detached arm off the eastern entrance as a part of the main project * * * until the completion of the main work may demonstrate the necessity or otherwise of such a structure for additional shelter. This course seems all the more desirable in view of the fact that such a structure would necessarily interfere more or less with the main entrance about the end of the eastern arm."

In order to complete the main breakwater as originally intended and as modified, so far as regards the height of the eastern arm, it was estimated that upward of 310,000 tons of rock over the amount to be provided by the then existing contract would be required, but as Congress did not make any additional appropriations the main breakwater was never fully completed.

The river and harbor act of June 13, 1902, contains the following item:

Improving Point Judith Harbor of Refuge, Rhode Island: Continuing improvement, one hundred thousand dollars, of which amount so much as may be necessary may, in the discretion of the Secretary of War, be expended in constructing

the easterly detached breakwater and continuing it to the shore with a view of providing a shelter for a landing place for the passengers, crews, and cargoes of vessels in distress and other vessels, and for the lifeboats of the Point Judith life-saving service.

From what precedes it is evident that the existing project requires the completion of the main breakwater as originally designed, the raising and consequent strengthening of the eastern arm, and finally the construction of the easterly detached breakwater if the necessity for it be demonstrated. In 1897 it was estimated that the completion of the main breakwater and raising the eastern arm would cost \$444,311. The easterly detached breakwater as originally designed will require, according to the report of the Board of 1896, 130,795 tons of stone, or, at \$1.50 per ton, \$196,193. According to a report made under date of April 14, 1897 (Annual Report of the Chief of Engineers, 1897, p. 937), in response to a call from Congress 900 feet of breakwater is required to continue the originally proposed easterly detached portion to the shore, at an estimated cost at that time of \$187,558.80.

A careful perusal of the item of the act quoted above would lead to the conclusion that the sum appropriated was to be applied to the main breakwater, leaving it discretionary with the Secretary of War, however, to apply such portion of the amount as may be necessary for constructing the easterly detached breakwater and continuing it to the shore. From the previous paragraph, however, it is readily seen that the money available is not sufficient for either the easterly detached breakwater or for the extension to the shore. The concluding portion of the item shows that the intent of Congress was to secure by the extension to the shore "a shelter for a landing place for the passengers, crews, and cargoes of vessels in distress and other vessels, and for the lifeboats of the Point Judith life-saving service." Moreover, the original survey was required of the "coast near life-saving service * * * with a view to constructing a breakwater," no doubt for the benefit of the life-saving service. The Board after careful consideration is of opinion that, since the sum appropriated is not sufficient for any of the parts of the work, it may be expended in carrying out the evident intention of Congress, namely, affording a shelter for a landing, provided such a shelter be found wanting and a necessity; furthermore, that the whole amount may be so applied if necessary to accomplish the object sought to be attained.

The life-saving station is to the north of the point and on the coast fronting east. This coast is covered with large, irregular boulders in very close proximity to each other. A narrow opening through these boulders, barely large enough for a skiff to pass through, is the only available place for the launching of the boats. It was a calm summer day when the Board visited the locality, yet the swell, though very slight, made landing there by no means safe. In a storm it is a physical impossibility to make a landing anywhere along the beach within a reasonable distance of the point, and among the papers referred to the Board will be found statements to the effect that no attempt could be made to save life endangered by the sea because of the impossibility to launch the necessary boats.

The Board concurs in the opinion of the Board of Engineers convened in 1896 that the construction of the easterly detached breakwater "would necessarily interfere more or less with the main entrance about the end of the eastern arm" of the main breakwater. Furthermore, it is of the opinion that the easterly detached breakwater will not give a shelter for a landing place such as is contemplated in the

act, but that such a shelter can only be obtained by constructing a breakwater out from the shore.

If the view taken by the Board that the entire sum may be expended, in the discretion of the Secretary of War, in constructing a breakwater from the shore in order "to provide a shelter for a landing place for passengers, crews, and cargoes of vessels in distress," etc., be approved, then it is recommended that the \$100,000 be so applied; that the breakwater be constructed along the line indicated on the accompanying drawing in red, as far as funds will permit, and that its dimensions in cross section conform to those of the main breakwater.

Very respectfully,

CHAS. R. SUTER,
Colonel, Corps of Engineers.

S. M. MANSFIELD,
Colonel, Corps of Engineers.

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

D 16.

LETTER OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY.

OFFICE OF CHIEF OF ENGINEERS,

U. S. ARMY,

Washington, October 24, 1902.

SIR: The river and harbor act of June 13, 1902, contains an item as follows:

Improving Point Judith Harbor of Refuge, Rhode Island: Continuing improvement, one hundred thousand dollars, of which amount so much as may be necessary may, in the discretion of the Secretary of War, be expended in constructing the easterly detached breakwater and continuing it to the shore with a view of providing a shelter for a landing place for the passengers, crews, and cargoes of vessels in distress and other vessels, and for the lifeboats of the Point Judith life-saving service.

The existing project for this breakwater, disregarding the modification as to constructing detached breakwater to shore, referred to in above item, is the construction of the main breakwater and the construction of an easterly detached breakwater, as shown in black on accompanying sketch. The work remaining to be done under the original project is the raising and strengthening of the eastern arm of the main breakwater, the extension of the west arm of main breakwater, and the construction of the eastern detached breakwater.

The river and harbor act of June 3, 1896, provided for a survey of "easterly breakwater to shore, Point Judith, at Point Judith Harbor of Refuge," and a report upon such survey was submitted and printed as House Document No. 53, Fifty-fifth Congress, first session, copy herewith.^a This report stated that the proposed extension to shore was not justified by the interests of commerce then involved, and made reference to the report of a previous Board of Engineers, which recommended that the construction of the detached breakwater itself could with advantage be postponed until the main breakwater was completed and the necessity of the detached arm more fully demon-

^a Not reprinted.

strated. The proposed extension of detached breakwater to shore is shown on the accompanying map in red. No action looking to an extension of the original project by addition of the shore extension of detached breakwater was taken by Congress until the passage of the law of 1902, containing the item previously quoted.

A Board of Engineers which has recently had this improvement under consideration states as follows in its report:

The Board, after careful consideration, is of opinion that since the sum appropriated is not sufficient for any of the parts of the work it may be expended in carrying out the evident intention of Congress, namely, affording a shelter for a landing, provided such a shelter be found wanting and a necessity; furthermore, that the whole amount may be so applied, if necessary to accomplish the object sought to be attained.

* * * * * *

The Board concurs in the opinion of the Board of Engineers convened in 1896, that the construction of the easterly detached breakwater "would necessarily interfere more or less with the main entrance about the end of the eastern arm" of the main breakwater; furthermore, it is of the opinion that the easterly detached breakwater will not give a shelter for a landing place such as is contemplated in the act, but that such a shelter can only be obtained by constructing a breakwater out from the shore.

If the view taken by the Board—that the entire sum may be expended, in the discretion of the Secretary of War, in constructing a breakwater from the shore, in order "to provide a shelter", * * * then it is recommended that the \$100,000 be so applied.

While the report of the Board of Engineers and the evidence presented by the interests of navigation would indicate that a greater immediate good would come from the construction of a breakwater from the shore than from the expenditure of the appropriation for raising and strengthening the main breakwater, the question arises whether the construction of the breakwater from shore, as proposed by the Board, can be legally carried out. The law authorizes the Secretary of War to use so much of the appropriation as may be necessary "in constructing the easterly detached breakwater and continuing it to the shore."

It is respectfully recommended that the opinion of the proper legal officer of the Government be obtained as to the requirement of the law, and whether such law will permit the construction of the "shore extension" of "the proposed easterly detached breakwater" in advance of the construction of the "detached breakwater" itself, or requires that such detached breakwater be first constructed before giving consideration to the extension of said breakwater to the shore.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

Hon. ELIHU ROOT,
Secretary of War.

[First indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., November 14, 1902.

Respectfully returned to the Secretary of War.

For a statement of this case, reference is made to the report of the Board of Engineers accompanying these papers, which as to the more material facts is full and complete.

It appears from this report and accompanying papers that the approved project for the improvement of Point Judith Harbor required the construction of (1) a main breakwater V-shaped, inclosing in considerable portion of the proposed "harbor of refuge," and (2) a detached breakwater to cover the gap between the extremity of the eastern arm of the main work and the shore, as indicated upon submitted maps; that appropriations for these improvements, aggregating \$1,250,000, based on this approved project, were made in the river and harbor acts of September 19, 1890, and July 13, 1892, and in the sundry civil acts of March 3, 1893, August 18, 1894, March 2, 1895, June 11, 1896, and June 4, 1897, it being specified in each of these acts that the appropriation made was "for harbor of refuge at Point Judith, Rhode Island, continuing improvement," or for constructing such a harbor, no mention being made in any of them of either breakwater, and that all appropriations have been expended on the main breakwater, not yet completed, the construction of the detached breakwater not having as yet been commenced.

It further appears from said report (paragraph 7) that of the work projected for this harbor there remains to be done (1) the completion of the main breakwater and the raising and strengthening the eastern arm thereof at an estimated cost of \$444,311; (2) the construction of the detached breakwater at an estimated cost of \$196,193, and (3) the construction of the shore extension of the detached breakwater at an estimated cost of \$187,558.80.

No appropriations for the harbor were made after 1897 until the passage of the last river and harbor bill—act of June 13, 1902—in which the following provision was made:

Improving Point Judith Harbor of Refuge, Rhode Island: Continuing improvement, one hundred thousand dollars, of which amount so much as may be necessary may, in the discretion of the Secretary of War, be expended in constructing the easterly detached breakwater and continuing it to the shore, with a view of providing a shelter for a landing place for the passengers, crews, and cargoes of vessels in distress, and other vessels, and for the lifeboats of the Point Judith life-saving service.

The amount appropriated above being insufficient to complete the whole of this work or any single part thereof, the question arises whether, in view of the language of this act, to wit, "constructing the easterly detached breakwater and continuing it to the shore," the whole of the appropriation may be used for the construction of the shore part of this work prior to the construction of the work of which it is an extension. Upon this point the Board of Engineers comments as follows:

A careful perusal of the item of the act quoted above would lead to the conclusion that the sum appropriated was to be applied to the main breakwater, leaving it discretionary with the Secretary of War, however, to apply such portion of the amount as may be necessary for constructing the easterly detached breakwater and continuing it to the shore. From the previous paragraph, however, it is readily seen that the money available is not sufficient for either the easterly detached breakwater or for the extension to the shore. The concluding portion of the item shows that the intent of Congress was to secure by the extension to the shore "a shelter for a landing place for the passengers, crews, and cargoes of vessels in distress, and other vessels, and for the lifeboats of the Point Judith life-saving station." Moreover, the original survey was required of the "coast near life-saving service * * * with a view to constructing a breakwater," no doubt for the benefit of the life-saving service. The Board, after careful consideration, is of opinion that, since the sum appropriated is not sufficient for any of the parts of the work it may be expended in carrying out the evident intention of Congress, namely affording a shelter for a landing, provided such a shelter be found wanting and a necessity; furthermore, that the whole amount may be so applied if necessary to accomplish the object sought to be attained.

In this conclusion I concur. Bearing in mind that the shore breakwater is not an auxiliary work, the usefulness of which depends upon the prior construction of the work of which it is an extension, but forms, with the latter, a single improvement, I think it would be exceedingly strained construction to hold that, because referred to in legislation as an extension of other work, the order of construction was thereby so irrevocably fixed as to be beyond the power of the Secretary of War to vary. For this reason, and for the further one that the shore extension appears to be the only part of the projected work primarily adapted to furnishing facilities for the life-saving service at Point Judith, the establishment of which seems to have been contemplated by Congress in its earlier legislation and which in this last legislation is expressly provided for, I am of opinion that construction of such extension may be now undertaken and that the whole of the present appropriation is available for that purpose.

GEO. B. DAVIS,
Judge-Advocate-General.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 19, 1902.

Respectfully returned to the Secretary of War.

The Judge-Advocate-General having decided in first indorsement hereon that the funds appropriated by the river and harbor act of June 13, 1902, for improving Point Judith Harbor of Refuge can be applied to construction of shore extension of easterly breakwater, as recommended by a Board of Engineers in the accompanying report of September 16, 1902, approval of the application of the funds as therein presented is recommended. The expenditure of the amount provided in the manner proposed is left to the discretion of the Secretary of War by the terms of the act.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fourth indorsement.]

WAR DEPARTMENT, *November 24, 1902.*
Approved as recommended by the Chief of Engineers.
WM. CARY SANGER,
Assistant Secretary of War.

D 12.

IMPROVEMENT OF ENTRANCE TO POINT JUDITH POND, RHODE ISLAND.

Operations during the past fiscal year.—No work done. The expenditures were on account of the expenses of the Board of Engineers considering the subject of harbors in this locality.

Operations contemplated for the fiscal year ending June 30, 1904.—The expenses of the Board of Engineers will be paid from the balance remaining to the credit of the appropriation for this work.

Money statement.

July 1, 1902, balance unexpended.....	\$9,481.62
June 30, 1903, amount expended during fiscal year.....	719.14
July 1, 1903, balance unexpended.....	8,762.48

AMOUNTS APPROPRIATED.

July 13, 1893.....	\$7,500
August 18, 1894.....	2,500
Total.....	10,000

COMMERCIAL STATISTICS.

For the commercial statistics see report for harbor of refuge at Point Judith, R. I.

D 13.

HARBOR OF REFUGE AT BLOCK ISLAND, RHODE ISLAND.

For history and project see page 101 of this report.

Operations during the past fiscal year.—Just prior to the close of the last fiscal year the entrance to the inner harbor had been dredged to a depth of 10 feet at mean low water, but further shoaling occurred almost immediately, so that additional dredging was required, and a contract was entered into under date of August 20, 1902, with J. S. Packard Dredging Company, of Providence, R. I., for dredging about 12,000 cubic yards of sand from the entrance to the harbor and the area between the steamboat wharf and the north wall of the enlarged inner harbor, at the rate of 23 cents per cubic yard. Work under this contract was commenced August 23, 1902, and completed early in September, 1902, 11,640 cubic yards of sand being removed.

Under date of January 19, 1903, a contract was entered into with E. S. Belden & Sons, of Hartford, Conn., for repairing the old breakwater and making certain portions of it sand tight. Amount of contract, about \$20,000. Price, \$2.17 per ton. Time of commencement, April 1, 1903; completion within four working months.

The placing of stone in the breakwater was commenced June 26, 1903, and up to the close of the fiscal year 610 tons of stone were placed in the work.

Early in the spring the shoaling at the entrance to the harbor again became serious and it was only with difficulty that the steamboats could enter. Under instructions of the Chief of Engineers an emergency agreement was made with T. A. Scott, of New London, Conn., to dredge the shoal at the entrance at the rate of 50 cents per cubic yard. Under this agreement 2,954 cubic yards of sand were removed between June 8, 1903, and June 20, 1903.

Lights were maintained at the entrance to the harbor during the year by the Engineer Department.

Operations contemplated for the fiscal year ending June 30, 1904.—

It is proposed to repair a portion of the main breakwater and make it sand tight; also to remove the portion of the north wall of the inner harbor between the breakwater and the entrance to the harbor.

Money statement.

July 1, 1902, balance unexpended	\$35,209.91
June 30, 1903, amount expended during fiscal year	^a 8,699.10
July 1, 1903, balance unexpended	26,510.81
July 1, 1903, outstanding liabilities	2,866.62
July 1, 1903, balance available	23,644.19
July 1, 1903, amount covered by uncompleted contracts	18,676.30
(Amount (estimated) required for completion of existing project	48,985.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	48,985.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

July 11, 1870	\$30,000.00	July 13, 1892	24,000.00
March 3, 1871	75,000.00	August 18, 1894	2,500.00
June 10, 1872	50,000.00	June 3, 1896	5,000.00
March 3, 1873	50,000.00	March 3, 1899	10,000.00
June 23, 1874	20,000.00	April 15, 1902	4,500.00
March 8, 1875	20,000.00	June 13, 1902	30,000.00
August 14, 1876	40,000.00	Total	451,000.00
July 14, 1880	6,000.00	Amount returned to United States Treasury	2,108.83
August 2, 1882	19,000.00	Total	448,891.17
July 4, 1884	15,000.00		
August 5, 1886	20,000.00		
August 11, 1888	15,000.00		
September 19, 1890	15,000.00		

CONTRACT IN FORCE.

Contractor: E. S. Belden & Sons.
 Date of approval: February 5, 1903.
 To commence not later than April 1, 1903.
 To complete in four working months after commencement.
 Rate per ton of 2,000 pounds in place: \$2.17.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving Block Island by water during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from local parties):

Commerce arriving at and leaving Block Island, calendar year, 1902.

	Tons.
Cotton and products	20
Tobacco	40
Rice	15
Grains and forage	4,100

^a Returned to Treasury United States \$2,108.83.

HARBOR OF REFUGE AT BLOCK ISLAND, R.I.

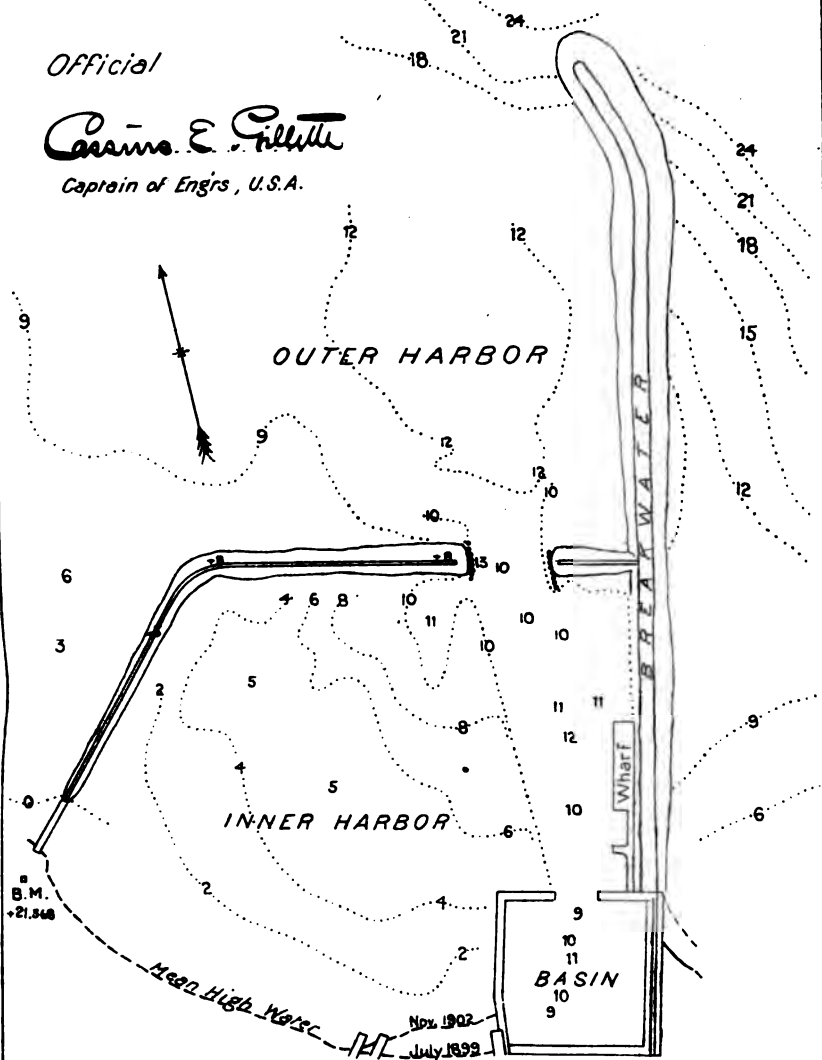
100 0 200 400 600 FEET

Depths refer to Mean Low Water.

Official

Cassius E. Felt

Captain of Engrs., U.S.A.



R. 8. '03.

ANDREW B. BARNHAM, PHOTO-LITHO WASHINGTON, D.C.

Eng 58 1

THE FUTURE OF THE PAPER

THE FUTURE OF THE PAPER is a book by the author of the first book in the series, 'The Future of the Paper'.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

The book is a collection of essays by the author, which are arranged in a chronological order.

	Tons.
Vegetables and truck	1,100
Live stock and products	4,150
Fish, oysters, etc	20,000
Naval stores	20
Lumber and products	8,700
Coal, minerals, etc	16,000
Fertilizers	1,600
Machinery	280
General merchandise	8,000
Sundries	11,000
Total	75,025

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
		<i>Feet.</i>	
Steam:			
Freight and passenger	1,000	7½	500
Freight, mainly	100	8	275
Passenger, mainly	210	7½	350
Fishing	1,800	9	175
Tugs	455	8	175
Pleasure boats	2,100	8½	150
Sail:			
Freight	750	9	150
Fishing boats	9,600	8	75
Oyster boats	210	7	30
Pleasure boats, large	2,600	8½	25
Pleasure boats, small	9,000	8½	10
Barges	55	10	350

D 14.

IMPROVEMENT OF GREAT SALT POND, BLOCK ISLAND, RHODE ISLAND.

For history and project, see page 102 of this report.

Operations during the past fiscal year.—A contract was entered into under date of December 26, 1902, with E. S. Belden & Sons, of Hartford, Conn., for extending the south jetty at the entrance to this harbor. Amount of contract, \$32,000, less the expenses of supervision and contingencies. Price, \$1.23 per ton. Time of commencement, April 1, 1903; to be completed within nine working months.

The deposit of stone in the jetty was commenced April 28, 1903. Up to the end of the fiscal year 12,545 tons had been placed in the extension of the jetty.

A contract for dredging the shoal at the sea end of the entrance to the harbor was entered into under date of December 29, 1902, with Charles H. Latham, of Hartford, Conn. Amount of contract, \$12,000, less the expenses of supervision and contingencies. Time of commencement May 1, 1903, extended to July 1, 1903; completion within five months. Price of dredging, 26.7 cents per cubic yard. Work under this contract was commenced June 6, 1903, and up to the close of the fiscal year 1,992 cubic yards had been dredged.

Operations contemplated for the fiscal year ending June 30, 1904.—It is proposed to apply the available funds to extending the south jetty and dredging as provided in the act of June 13, 1902.

Money statement.

July 1, 1902, balance unexpended	\$50,000.00
June 30, 1903, amount expended during fiscal year	5,072.68
July 1, 1903, balance unexpended	44,927.32
July 1, 1903, outstanding liabilities	11,575.76
July 1, 1903, balance available	33,351.56
July 1, 1903, amount covered by uncompleted contracts	25,037.79
{ Amount (estimated) required for completion of existing project	165,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1903, in addition to the balance unexpended July 1, 1903	165,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

AMOUNTS APPROPRIATED.

June 3, 1896	\$40,000.00
March 3, 1899	50,000.00
June 18, 1902	50,000.00
Total	140,000.00

CONTRACTS IN FORCE.

	For jetty work.	For dredging.
Contractor	E. S. Belden & Sons	Charles H. Latham.
Date of approval	January 9, 1903	January 12, 1903.
To commence	Not later than April 1, 1903	Not later than May 1, 1903.
To complete	In nine months after commencement.	In five working months after commencement.
Rates	\$1.23 per ton of 2,000 pounds stone in place.	26.7 cents per cubic yard.

COMMERCIAL STATISTICS.

The commerce arriving at and leaving the Great Salt Pond, Block Island, R. I., by water during the calendar year ending December 31, 1902, is estimated as follows (based mainly upon reports received from Mr. Christopher E. Champlin and other citizens of Block Island, R. I.):

	Tons.
Grains and forage	4,000
Vegetables and truck	5,000
Live stock and products	1,000
Fish, oysters, etc	3,000
Lumber and products	3,000
Coal, minerals, etc	4,000
Fertilizers	300
Machinery	1,500
General merchandise	9,000
Sundries	5,000
Total	35,800

New transportation company established during the year: Long Island Railroad Company ran a boat from the eastern end of Long Island to the Great Salt Pond during July and August, 1902.

ANCE TO

Black Island Sound BLOCK ISLAND, R.I.

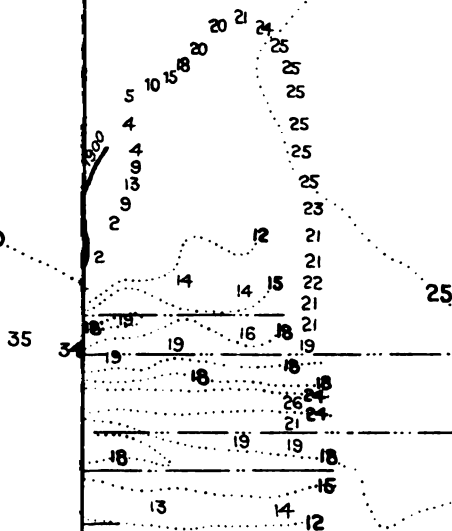
SCALE

600 800 1000 FT.

to Mean Low Water.

BLOCK ISLAND SOUND

GREAT SALT POND



P.B. '03.

The vessels entering and leaving this waterway are as follows (each entrance and departure together being counted as one):

Character or class of service.	Number.	Average draft.	Average tonnage.
Steam:		<i>Feet.</i>	
Freight and passenger	1,500	10	600
Fishing	2,500	12	400
Tugs	500	8	75
Pleasure boats	6,500	5	6
Sail:			
Freight	500	10	100
Fishing boats	8,500	10	800
Pleasure boats, large	5,000	6	10
Pleasure boats, small	2,000	3	5
Barges	500	10	700

D 15.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of steamer Williamsport.—This steamer, loaded with coal, sank 2 miles northeast of Pollock Rip light-ship. Her removal was authorized May 20, 1902. The work of removal was commenced in July and finished in October, 1902. Four thousand five hundred pounds of dynamite, in 175 charges, were expended in breaking up and scattering the pieces of the wreck over the surrounding bottom. At the completion of the work there was from 22 to 27 feet of water at mean low tide over the site of the wreck.

The cost of the removal was \$4,024.21.

Wreck of schooner Thomas Borden.—This schooner, loaded with lime, was reported, July 22, 1902, as having been burned to the water's edge and sunk, April 10, 1902, in Hyannis Harbor, Massachusetts. Removal of the wreck was authorized July 30, 1902, and the work was completed in October.

The cost of the removal was \$791.95.

Barge Wadena.—This vessel was wrecked on Shovelful shoal south of Monomoy Point, Massachusetts, and reported July 22, 1902. Her removal was authorized July 30, 1902, and completed in October, 1902. Two thousand four hundred pounds of dynamite, in 232 charges, were expended in breaking her up. The depth of water was 14 feet at mean low tide over the site of the wreck when the work was completed.

The cost of the removal was \$570.10.

Schooner St. Thomas.—This vessel was sunk 3 miles southeast of Cape Poge light-house in Muskeget channel and was reported February 17, 1902, and a request was made by the owners that the wreck be not removed by the Government until they had made a contract to have it raised. They were given until May 1, 1902, by War Department letter of March 10, 1902, in which to do this, extended by War Department letter of May 28, 1902, to July 1, 1902.

Up to the close of September, 1902, the owners had failed to remove the wreck. The removal by the United States was authorized by the Secretary of War December 17, 1902, and completed in January, 1903. Four hundred and fifty pounds of dynamite, in 41 charges, were used in destroying the wreck. Upon completion there was from 23 to 26 feet of water over the site of the wreck.

The cost of the removal was \$800.

Schooner James G. Blaine.—This vessel was reported, February 12, 1903, as having been wrecked in January off Monomoy Point, Massachusetts, about 1 mile SSE. from Monomoy Point light-house and about three-fourths of a mile ENE. from the Shovelful light-ship. The removal of this wreck was authorized March 2, 1903. Nothing was found of the wreck when the wrecking party reached the locality except a portion of the side of a vessel, supposed to be a part of the *James G. Blaine*. Fifteen pounds of dynamite were expended in breaking this up. Diligent search was made but no other portions were found.

The cost of removal was \$692.34, including the *Emily G. Sawyer*.

Schooner Emily G. Sawyer.—This vessel was wrecked during January, 1903, in about 14 feet of water, $1\frac{1}{4}$ miles SW. from Hardings Beach light-house, and was reported February 12, 1903. The removal was authorized March 2, 1903, and completed early in April, 1903. Four hundred and fifty pounds of dynamite, in 54 charges, were expended in removing the wreck.

The cost of the removal was \$692.34, including the *James G. Blaine*.

Schooner Sarah Potter.—This vessel was reported, April 1, 1903, as having been wrecked off the Handkerchief shoal, Massachusetts, in March, 1903. She was loaded with coal and sunk in from 18 to 20 feet of water. The removal was authorized April 6, 1903, and nearly completed at the close of the fiscal year.

The wrecks of the following vessels were reported as dangerous obstructions to navigation on June 9, 1903, and their removal authorized June 25, 1903. The work of removal will be commenced as soon as the wrecking party can be sent out. Schooner *Marriot*, sunk 10 miles WSW. from Vineyard Sound light-ship, Massachusetts; schooner *Dora Mathews*, sunk near Bass Rip, 3 miles east of Sankaty Head, Nantucket, Mass.; schooner *Agnes E. Manson*, sunk in the same locality as the *Dora Mathews*, and the barge *Fidelia*, sunk 3 miles west of Hen and Chickens light-ship, in the path of vessels running into Buzzards Bay.

D 16.

ESTABLISHMENT OF HARBOR LINES AT NEW BEDFORD HARBOR, INCLUDING FAIRHAVEN, AND ACUSHNET RIVER, MASSACHUSETTS.

FALL RIVER, MASS., September 4, 1902.

My DEAR SIR: Inclosed I send you a petition^a from the citizens of New Bedford, Mass., requesting that the harbor lines of New Bedford be defined. I most respectfully request that you give an early and favorably consideration to this petition.

Thanking you in advance for your favor, I remain, very respectfully,
WM. S. GREENE.

Hon. ELIHU ROOT,
Secretary of War, Washington, D. C.

^a Not printed.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 9, 1902.

Respectfully referred to Maj. George W. Goethals, Corps of Engineers, for report, attention being invited to the provisions of section 11 of the act of March 3, 1899.

To be returned.

By command of Brig. Gen. Gillespie:

A. MACKENZIE,
Colonel, Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE,
Newport, R. I., September 22, 1902.

Respectfully returned to the Chief of Engineers, U. S. A.

Mills recently constructed on the south water front and mills now in course of erection desire facilities for landing coal and other freight by water, and there is a movement on foot among the business men with a view to securing an appropriation for dredging an anchorage area between Palmers Island and the West Shore. The wharfage facilities to be provided under such circumstances by the mills will depend upon such a project.

There is also a question as to the dredging that should be done by the Government in the vicinity of the private wharves north of the bridge. Under these circumstances it is respectfully recommended that the request herein contained be complied with.

GEO. W. GOETHALS,
Major, Corps of Engineers.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 26, 1902.

Respectfully returned to Major Goethals.

The Chief of Engineers directs that Major Goethals take into consideration the question of the establishment of harbor lines for New Bedford Harbor, including Fairhaven, as petitioned for in the accompanying papers.

After the matter has been carefully studied and tentative lines have been drawn on a convenient map, the whole matter will be considered at a public hearing, previously advertised, at which all interested parties will be given full opportunity to examine the proposed lines and express their views thereupon. With his final report Major Goethals will submit a tracing showing the lines, with proper description, which in his opinion will best subserve the interests involved.

To be returned.

By command of Brig. Gen. Gillespie:

H. F. HODGES,
Major, Corps of Engineers.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 26, 1902.

Respectfully returned to the Secretary of War.

The Hon. William S. Greene, M. C., incloses, with request for favorable consideration, a petition from citizens of New Bedford and Fairhaven, Mass., requesting that harbor lines be established in New Bedford Harbor, including Fairhaven.

It will be seen by reference to the foregoing indorsements hereon that the district engineer officer has been instructed to take into consideration the question of establishing harbor lines at the localities mentioned and to submit a report, with tracings, showing such lines as in his opinion will best subserve the interests involved.

I recommend that Mr. Greene be informed of this action.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Eighth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 11, 1903.

Respectfully returned to the Secretary of War.

Previous action in this case is shown by sixth indorsement hereon.

The subject has been carefully investigated and the proposed harbor lines have been accepted at a public hearing, which was largely attended and at which all interested parties were given an opportunity to be heard.

I recommend that the lines selected, which are delineated on the accompanying chart^a and described in a separate paper, be approved by the Secretary of War, and that the Secretary place his approval upon the map and description, both of which have been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., December 29, 1902.

GENERAL: In compliance with indorsement of the Department, dated September 26, 1902, I have the honor to state that on December 3, 1902, a public hearing was held at New Bedford, Mass., at the rooms of the board of trade, on the proposed harbor lines for New Bedford, Fairhaven, and Acushnet River.

As a basis, the harbor lines as established by the board of land and harbor commissioners of the State of Massachusetts were taken and modified in a few minor particulars where they interfered with existing wharves, and where, in my opinion, the lines could be straightened without detriment to the interests of navigation.

^a Not printed.

As a result of the hearing a few other changes were made at the earnest solicitation of adjacent property owners, but of a very slight character, and the resulting tracing,^a herewith, was finally accepted at the hearing, which was very largely attended. It is therefore recommended that the lines proposed be adopted and established for New Bedford, Fairhaven, and the Acushnet River, so far as indicated on the map.

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[First indorsement.]

NORTHEAST DIVISION, ENGINEER OFFICE,
New York, December 30, 1902.

Respectfully forwarded to the Chief of Engineers, United States Army, recommended for approval.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
Division Engineer.

DESCRIPTION OF PROPOSED UNITED STATES HARBOR LINES FOR NEW BEDFORD
HARBOR, MASSACHUSETTS.

Line west side of harbor.—Beginning at a point designated on the accompanying map as point I, 1,758 feet easterly from the east line of South Water street, in the city of New Bedford, measured at right angles to the east line of said street, from a point 827 feet southerly from the south line of South street; thence northerly to the point II in the prolongation of the north line of Merrill's wharf, 200 feet easterly from its northeast corner and 1,320 feet from the east line of South Water street, measured on the north line of said wharf and its prolongations; thence northwesterly to the northeast corner of the northerly spur of Rotch's wharf (point III); thence northerly, passing the New Bedford and Fairhaven bridge, to the southeast corner of Wilcox & Redmond's wharf (point IV); thence northerly to the southeast corner of Samuel Rodman's wharf (point V), 559 feet, measured along the south face of the wharf and its prolongation from the east line of North Water street; thence northerly to the point VI in the prolongation of the south line of the railroad wharf at the foot of Wamsutta street, 840 feet easterly from the east line of Orange street; thence northerly to the point VII, 450 feet, measured parallel to the north side of Kilburn street prolonged, easterly from the northeast corner of a wall at the foot of Kilburn street; thence northeasterly to the point VIII, 50 feet south of the southeast corner of the west abutment of the Coggeshall Street Bridge, and in a line passing through said corner of the west abutment and a point IX 200 feet north, 81° 20' east from the north end of the stone wall along the river front of the Whitman mill, which latter point is about 400 feet north of Coffin avenue; thence from the point VIII to the point IX on the last-described line; thence northerly to a point X on the prolongation of the south side of the old Belleville wharf, 380 feet easterly from the east line of Belleville road leading to the head of Acushnet River.

Line on the east side of Acushnet River and New Bedford Harbor.—Beginning at the point designated as XI on the accompanying map,^a 680 feet easterly from the east line of Belleville road, measured along the south side of the old Belleville wharf and its prolongation; thence southerly parallel to the line IX-X described above 2,550 feet to a point XII near the 6-foot curve of depth on the east side of Acushnet River and about 180 feet from the high-water line of said river; thence

^aNot printed.

southerly about 2,160 feet to the southwest corner of the east abutment of the Coggeshall Street Bridge (point XIII) 450 feet from the point VIII above described; thence south 24° west about 1,830 feet to the point XIV, about 200 feet from the high-water line of the point now or formerly called "Isle Marsh," and also in the prolongation of the north side of Pond street, in the city of New Bedford; thence in the direction of the west abutment on Popes Island of the old New Bedford and Fairhaven bridge 1,200 feet to the point XV; thence southeasterly to the center of the face of the east or Fairhaven abutment of the present New Bedford and Fairhaven bridge (point XVI); thence southerly to the point XVII in the prolongation of the north side of the "Old South Wharf" and 30 feet westerly from the northwest corner of said wharf; thence southerly to the point XVIII in the prolongation of the south side of Central Wharf and 820 feet from the west line of Water street, in Fairhaven; thence southeasterly to a point XIX, which is in a line drawn parallel to William R. Rodman's wharf from a point on the west side of the road or street leading to Fort Phoenix, 500 feet north of the street leading to said wharf and 935 feet westerly from the west line of said road or street; thence southerly to a point XX, which is 830 feet west from the south end of the outer face of the west wall of Fort Phoenix.

Line around Popes Island.—Beginning at the center of the face of the east abutment on Popes Island of the New Bedford and Fairhaven bridge, at the point designated as XXI on the accompanying map; thence on a line making an angle of $49^{\circ} 12'$ with the axis of the section of the bridge extending from Fairhaven to Popes Island 1,832.9 feet to the point XXII; thence on a line making an interior angle of $73^{\circ} 37'$ with the line XXI-XXII 1,092.6 feet, more or less, to the point XXIII; thence on a line making an interior angle of $121^{\circ} 40'$ with the line XXII-XXIII 1,044.2 feet, more or less, passing through the center of the west abutment on Popes Island of the New Bedford and Fairhaven bridge to the point XXIV, which is 300 feet to the southward of the south side of said bridge; thence easterly in a line parallel to the section of the bridge crossing Popes Island and 800 feet from its south side 1,095 feet, more or less, to the point XXV, its intersection with a line through the point XXI making an angle of 50° to the south of the axis of the section of the New Bedford and Fairhaven bridge leading from Fairhaven to Popes Island; thence from point XXV to point XXI along the last-described line.

Line around Fish Island.—Beginning at the northwest corner of the west abutment on Fish Island of the New Bedford and Fairhaven bridge; thence northerly by a line passing 25 feet westerly from the northwest corner of the wharf forming the west and north sides of Fish Island to the point XXVIII at its intersection with a line parallel to the north face of said wharf and 20 feet to the northward of it; thence along said parallel line 150 feet to the point XXIX; thence easterly 38 feet, more or less, to the point XXX at the northeast corner of the wharf forming the north and east sides of Fish Island; thence southerly along the face of the wharf forming the east side of the island, passing the New Bedford and Fairhaven bridge, 610 feet, more or less, to the intersection, point XXXI, with a line making an interior angle of 181° with the line XXX-XXXI, and passing 20 feet to the eastward of the southeast corner of the wharf immediately south of said bridge; thence along the last described line 635 feet to the point XXXII; thence westerly by a line, making an interior angle of 139° , 70 feet to the point XXXIII; thence northwesterly by a line, making an interior angle of 144° , 119.5 feet to the point XXXIV; thence northerly to the southwest corner of the stone wharf on the westerly side of Fish Island, XXXV; thence along the westerly face of said stone wharf to its northwest corner, XXXVI; thence along the north face of said wharf 150 feet to the point XXXVII; thence northerly to the northwest corner of the west abutment on Fish Island of the New Bedford and Fairhaven bridge, the place of beginning on Fish Island.

Line around Crow Island.—Beginning at a point XXXVIII, 1,340 feet westerly from the west line of Water street in Fairhaven, and 40 feet north of the prolongation of the north side of Center street; thence 300 feet westerly, parallel to said Center street, to the point XXXIX; thence a line northerly, making an interior angle of 63° , 1,040 feet to the Point XL; thence a line easterly, making an interior angle of $97^{\circ} 10'$, 360.3 feet to the point XLI; thence a line southerly, making an interior angle of $97^{\circ} 7'$, 517.8 feet to the point XLII; thence a line southwesterly, making an interior angle of $139^{\circ} 43'$, 497.8 feet to the point XXXVIII, the place of beginning for Crow Island.

WAR DEPARTMENT,
March 18, 1903.

Approved.

E. Root, Secretary of War.

D 17.

ESTABLISHMENT OF HARBOR LINES ON PAWTUCKET (SEEKONK) AND PROVIDENCE RIVERS, PROVIDENCE HARBOR, RHODE ISLAND.

STATE OF RHODE ISLAND, ETC.,
OFFICE OF THE HARBOR COMMISSIONERS,
Providence, R. I., February 16, 1901.

SIR: The board of harbor commissioners of the State of Rhode Island, etc., has had prepared a set of plans representing the harbor lines which have been established under State authority in that portion of the waters of the State which are placed by statute under the jurisdiction of the board of harbor commissioners.

Inasmuch as the Congress of the United States, by section 11 of the river and harbor act approved March 3, 1899, authorizes the Secretary of War to cause such lines to be established, the State board respectfully asks that you will take such action as is necessary to establish harbor lines along such reaches of shore as are now covered by the lines established under State authority, and if it is found that the lines represented upon the plans,^a which are herewith sent to you under another cover by express, meet your approval, the State board asks that they may be established without change. There is one exception to this request. On sheet No. 5 of the plans sent you there is represented a line from D to H, indicating a change in the position of the harbor line, which the State board has recommended the general assembly of the State to adopt, and the act adopting this line from D to H in place of the broken line heretofore established has passed the senate and will undoubtedly pass the house. The State board therefore asks that if it is consistent with your views that you establish this line instead of those otherwise represented for this stretch of shore.

Respectfully,

J. HERBERT SHEDD,
Chairman.

Hon. ELIHU ROOT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 20, 1901.

Respectfully referred to Maj. George W. Goethals, Corps of Engineers, for report.

To be returned.

By command of Brig. Gen. Wilson:

A. MACKENZIE,
Lieut. Col., Corps of Engineers.

[Third indorsement.]

U. S. ENGINEER OFFICE,
Newport, R. I., March 7, 1901.

Respectfully returned to the Chief of Engineers.

The most important harbor for which the State harbor commissioners submit harbor lines is that of Providence, and I am informed

^a Not printed.

that at a hearing given by the harbor commissioners the various opposing interests to the lines as laid down on accompanying maps^a were ultimately satisfied by compromise. It is questionable whether, under such circumstances, this matter should receive action by the Department until a public hearing can be given to all concerned, under the auspices of the War Department, as it is possible that the objectors were aware that the action of the State authorities could not be final. The lines as laid down appear to be, in the main, well adapted to the various localities, but the final determination of their position should be made only after full public hearings, and the lines then definitely marked by permanent monuments, so that they can be easily found on the ground. This can only be done, however, at some expense, and as no funds are now available, I would recommend that this whole matter be left in abeyance until some more pressing necessity than now exists requires the establishment of such lines. Before any work of enlarging the anchorage at Providence is undertaken, the harbor lines should be established, but as the river and harbor bill has failed of passage, it is deemed best to let the State establish such lines as it sees fit, but not to give them the sanction of the War Department.

GEO. W. GOETHALS,
Major, Corps of Engineers.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 12, 1901.

Respectfully returned to the Secretary of War.

The State harbor commissioners of Rhode Island submit drawings^a showing harbor lines established by the State for certain waterways within its limits, and request that the War Department take up the matter and establish the lines in accordance with Federal law.

The subject has been under consideration by Major Goethals, to whose report, in third indorsement hereon, attention is respectfully invited. I concur in the views of Major Goethals and recommend that the chairman of the board of harbor commissioners be advised that the Department finds it inexpedient at this time to establish harbor lines in the waters of Rhode Island, but that the subject will be taken up and definitely considered as soon as circumstances will permit. In the meantime no objection will be made to the establishment of harbor lines by the State authorities, and the existence of such lines will have proper consideration in connection with matters affecting them which may come before the Department for action.

A. MACKENZIE,
Acting Chief of Engineers.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 27, 1903.

Respectfully returned to the Secretary of War.

Previous action in this case is shown by the preceding indorsements and by the accompanying copy of War Department letter^a of March 13, 1901.

^a Not printed.

The matter of establishing harbor lines at Providence, R. I., has been taken up in connection with the work of improving Providence River and Harbor, under appropriation made by the act of June 13, 1902. The proposed lines have been considered at a public hearing and, it is believed, are those which will best subserve the various interests involved.

I recommend that the lines selected, which are delineated on the accompanying tracing^a and described in a separate paper, be approved by the Secretary of War and that the Secretary place his approval upon said tracing and description, both of which have been prepared for his signature.

With the sanction of the Secretary of War, a copy of the chart, if approved, will be sent to the State harbor commissioners of Rhode Island.

A. MACKENZIE,
Acting Chief of Engineers.

[Seventh indorsement.]

WAR DEPARTMENT,
March 30, 1903.

Approved as recommended by the Acting Chief of Engineers.

E. ROOT,
Secretary of War.

LETTER OF J. HERBERT SHEDD, CHAIRMAN HARBOR COMMISSIONERS.

STATE OF RHODE ISLAND, ETC.,
OFFICE OF THE HARBOR COMMISSIONERS,
Providence, R. I., March 22, 1901.

SIR: I have the honor to acknowledge the receipt of your letter of the 13th instant in relation to the establishment of harbor lines in this State, and saying that the Department finds it inexpedient at this time to establish harbor lines in the waters of Rhode Island. While this action on the part of the Department is regretted, it is hoped that there may not be any great delay before the matter can be taken up and definitely considered.

I wish at present to say, in addition to the statement made in my communication to you on the 16th ultimo, that the general assembly of the State of Rhode Island has fully acted upon and established, so far as it may do so, the line from D to H on sheet No. 5 of the plans sent you, and to which I referred in my communication; the course of this line being south 5° 54' 49" west, and its length 1,024.47 feet. I will send a plan representing the relation of this line to the lines formerly defined between the lines D to H to Major Goethals, at Newport.

Respectfully,

J. HERBERT SHEDD,
Chairman Harbor Commissioners.

Hon. ELIHU ROOT,
Secretary of War.

REPORT OF MAJ. GEO. W. GOETHALS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Newport, R. I., December 23, 1902.

GENERAL: The river and harbor act of June 13, 1902, contains a provision for improving Providence River and Harbor, Rhode Island, the work to be done in accordance with report submitted in House

^a Not printed.

Document No. 108, Fifty-sixth Congress, first session, and the estimates therein contained are based on dredging being done along and within certain harbor lines.

The approved project for the expenditure of the appropriation made in the act required the establishment of harbor lines for Providence Harbor, and under authority granted October 25, 1902, a public hearing was advertised and held at the office of the board of harbor commissioners in the State capitol on December 2, 1902.

As a result of the hearing, I have the honor to forward herewith a tracing showing the proposed line, with the request that it be approved. The State harbor lines were taken as a basis, and where modifications are made, they were made with a view to straightening the line and with the consent of the adjacent property owners and of the State board of harbor commissioners.

It will be noted that the proposed harbor line cuts across Fields Point, and in the tracing submitted for consideration at the hearing this line was modified, but at the earnest solicitation of the city authorities now in office and those recently elected the line was changed to conform to that previously adopted by the State. The city owns this point, and on account of the narrowness of the river at this locality all interested parties are opposed to the erection of any additional structures which might tend to contract the stream more than its present condition shows, and the city further pledges itself to do what it can toward securing the removal of the point back to the harbor line, the work to be done by the city in connection with the dredging above Fox Point, which has heretofore been done by the same corporation.

Very respectfully, your obedient servant,

GEO. W. GOETHALS,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.
(Through the Division Engineer.)

[Seventh indorsement.]

ENGINEER OFFICE, NORTHEAST DIVISION,
New York, March 20, 1903.

Respectfully forwarded to the Chief of Engineers, United States Army, recommended for approval.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
Division Engineer.

PROPOSED UNITED STATES HARBOR LINES FOR PROVIDENCE HARBOR, RHODE ISLAND.

[NOTE.—All bearings given in the following descriptions of the proposed harbor lines are the true bearings referred to the true meridian through the United States Coast and Geodetic Survey station, Fort Independence, near Fields Point, Providence.]

Harbor line on easterly side of Seekonk River and Providence River.—Beginning at a point designated as A on the accompanying map, near the easterly side of the Seekonk River, about 15.72 feet westerly from the east end of the north iron curbing of the Central or Red Bridge over the Seekonk River, which point is more definitely located by reference to the stone foundation or underpinning of the building of the Standard Oil Company, immediately south of the east approach to the bridge, being north $30^{\circ} 45' 16''$ east, 66 feet from a point in the prolongation of the north face of the said stone foundation and 18.29 feet westerly from its northwest corner, the angle included between the line to the point A and

the line of the north face of the foundation wall being $89^{\circ} 35'$; thence south $30^{\circ} 45' 16''$ west 3,692.49 feet, passing the Washington Bridge to the point B; thence south $13^{\circ} 28' 12''$ west 422.12 feet to the point D; thence 751.77 feet on a circular curve having a radius of 450 feet, the center of which, E, is on India Point in the city of Providence and bears north $76^{\circ} 31' 48''$ west from the point D to the point F, from which the center E bears north $19^{\circ} 11' 18''$ east; thence south $72^{\circ} 53' 54''$ west 448.62 feet to the point G; thence north $62^{\circ} 59' 54''$ west 320.55 feet to the point H; thence 117.83 feet on a circular curve with a radius of 100 feet, the center of which, I, is on Bold Point in East Providence and bears south $27^{\circ} 00' 06''$ west from the point H to the point J, from which the center I bears south $40^{\circ} 30' 45''$ east; thence south $49^{\circ} 29' 15''$ west 700 feet to the point K; thence south $25^{\circ} 14' 14''$ west 831.81 feet to the point L; thence south $6^{\circ} 53' 49''$ west 300 feet to the point M; thence south $13^{\circ} 45' 46''$ east 300 feet to the point N, near the northwest corner of the Wilkesbarre pier; thence south $26^{\circ} 21' 25''$ east 101.39 feet to the point O, near the southwest corner of the Wilkesbarre pier; thence south $36^{\circ} 29' 33.5''$ east 6,811.83 feet to the point P, which is 43.11 feet from a copper bolt set in the rock forming Kettle Point, from which bolt the angles to the point P are $21^{\circ} 13'$ from Fullers Rock light-house and $104^{\circ} 08' 20''$ from Sassafas Point light-house.

Harbor line on the north and west sides of the Seekonk River and the east side of the north arm of Providence River.—The point of beginning, a, of this line is located from a base point near the west end of the Central or Red Bridge; the location of this point is shown on the enlarged plan on the accompanying map and is designated thereon as D'.

The point a is north $43^{\circ} 20' 40''$ east 27.9 feet; the point b, south $25^{\circ} 31' 15''$ east 6.87 feet, and the point c, South $27^{\circ} 14' 15''$ west 129.96 feet from the base point D'.

Beginning at the point a; thence south $31^{\circ} 26' 03''$ west 31.05 feet to the point b; thence south $29^{\circ} 43' 34''$ west 125.915 feet to the point c; thence south $57^{\circ} 35' 48''$ west 2,409.04 feet to the point d, which is in the prolongation of the south side of William street in the city of Providence and 401.47 feet easterly from the east line of Gano street; thence south $5^{\circ} 54' 49''$ west 1,024.47 feet to the point e, which is in the south line of Wickenden street in the city of Providence and 182.48 feet to the eastward of the east line of Gano street; thence south $9^{\circ} 19' 46''$ east 1,187.36 feet to the point f, crossing the north line of India street, Providence, 207.89 feet to the northward of the point f, and 418.42 feet easterly from the east line of Gano street; thence south $10^{\circ} 37' 33''$ west 85.5 feet to the point g; thence south $25^{\circ} 21' 20''$ west 47.79 feet to the point h; thence south $27^{\circ} 35' 40''$ west 96.06 feet to the point i; thence south $75^{\circ} 22' 36''$ west 817.3 feet to the point j; thence north $74^{\circ} 26' 08''$ west 187.16 feet to the point k; thence north $53^{\circ} 50' 25''$ west 190.66 feet to the point l; thence north $68^{\circ} 41' 36''$ west 317.97 feet to the point m; thence north $81^{\circ} 53' 58''$ west 802.164 feet to the point p; thence south $79^{\circ} 30' 56''$ west 166.45 feet to the point r; thence south $68^{\circ} 9' 20''$ west 217.54 feet to the point s; thence south $48^{\circ} 11' 28''$ west 737.77 feet to the point t; thence south $36^{\circ} 45' 12''$ west 437.31 feet to the point u on the easterly side of Fox Point wharf; thence south $10^{\circ} 12' 54''$ east 399.29 feet to the point v, near the southeast corner of said wharf; thence along the south and west faces of the said wharf south $63^{\circ} 09' 54''$ west 37 feet to the point w; thence north $41^{\circ} 36' 36''$ west 3 feet to the point x; thence north $41^{\circ} 36' 33''$ west 124.13 feet to the point y; thence north $32^{\circ} 15' 21''$ west 602.39 feet to the point z, which is on a line 24.84 feet south of the north line of India street, and is 135.44 feet from the east line of South Water street, measured at right angles to that line; thence following the general course of the wharf line along the east side of the north arm of Providence River north $29^{\circ} 46' 19''$ west 223.61 feet to the point a'; thence north $32^{\circ} 18' 52''$ west 595.68 feet to the point b'; thence north $32^{\circ} 4' 50''$ west, passing the Point Street Bridge 597.46 feet to the point c'; thence north $32^{\circ} 37' 18''$ west 358.18 feet to the point d', in the north line of Transit street, and 121.31 feet from the east line of South Water street, measured at right angles to that line; thence north $34^{\circ} 16' 15''$ west 720.58 feet to the point e'; thence north $34^{\circ} 54' 23''$ west 321.8 feet to the point f'; thence north $32^{\circ} 33' 36''$ west 223.47 feet to the point g'; thence north $27^{\circ} 58' 06''$ west 340.27 feet to the point h'; thence north $26^{\circ} 35' 35''$ west 112.38 feet to the point i'; thence north $25^{\circ} 23'$ west 148.23 feet to the point j', on the south side of Crawford Street Bridge, and 54.185 feet from the east line of South Water street at the corner of Crawford street.

Line on the west side of Providence River.—Beginning at a point on the south side of Crawford Street Bridge, in the city of Providence, 115.61 feet at right angles to the west line of Dyer street and 174.66 feet southeasterly from distant southwest corner of Dyer street and Custom-House street, which point is designated as

k' on the accompanying map; thence south $23^{\circ} 25' 51''$ east 262.84 feet to the point l' ; thence south $22^{\circ} 42' 12''$ east 612.56 feet to the point m' ; thence south $23^{\circ} 50' 47''$ east 1,041 feet to the point n' ; thence south $23^{\circ} 45' 19''$ east 516.65 feet to the point o' on the west abutment of the Point Street Bridge. Then beginning on the south side of Point Street Bridge at a point p' in the south line of Point street and distant from the intersection of the prolongation of the east line of Eddy street from Ship street to Point street with the south line of Point street 595.57 feet; thence south $23^{\circ} 40' 16''$ east 2,146.19 feet to the point q' in the prolongation of the north line of Henderson street, distant 1,126.24 feet from the center of Allens avenue; thence south $23^{\circ} 56' 08''$ east 3,525.26 feet to the point r' , the direction of the line $q' r'$ being further defined by a stone obelisk or monument built on the north side of Sassafras Point; thence south $43^{\circ} 23'$ east 5,224.9 feet to the point s' on the south side of Fields Point, the southern terminus of the proposed line.

PROPOSED HARBOR LINES, PROVIDENCE, R. I.

[NOTE.—The points of the harbor lines are referred to the point A by a system of rectangular coordinates parallel and at right angles to the meridian through the United States Coast and Geodetic Survey station at Fort Independence, near Fields Point, Providence Harbor. South latitudes are +, north —, departures all west — +.]

Table of coordinates.

Station.	Latitude.	Departure.	Station.	Latitude.	Departure.
	Feet.	Feet.		Feet.	Feet.
A.....	0.00	0.00	r.....	3,311.06	4,332.51
B.....	3,173.22	1,888.20	s.....	3,302.00	4,534.43
D.....	3,683.73	1,986.53	t.....	3,883.84	5,064.34
E.....	3,478.91	2,424.16	u.....	4,234.22	5,346.02
F.....	3,903.91	2,572.06	v.....	4,627.18	5,275.20
G.....	4,035.83	3,000.84	w.....	4,643.88	5,308.22
H.....	3,890.30	3,236.45	x.....	4,641.64	5,310.21
I.....	3,979.40	3,331.85	y.....	4,548.83	5,392.94
J.....	3,903.37	3,396.81	z.....	4,090.41	5,714.14
K.....	4,358.10	3,329.00	a'.....	3,845.31	5,825.17
L.....	5,110.51	4,283.66	b'.....	3,341.88	6,143.60
M.....	5,408.34	4,319.68	c'.....	2,835.65	6,480.92
N.....	5,699.72	4,248.31	d'.....	2,533.95	6,654.02
O.....	5,790.57	4,203.80	e'.....	1,998.48	7,099.77
P.....	11,286.84	152.17	f'.....	1,674.58	7,243.71
a.....	-188.50	322.71	g'.....	1,493.20	7,364.71
b.....	-162.01	338.90	h'.....	1,185.67	7,523.71
c.....	-52.66	401.34	i'.....	1,065.18	7,574.00
d.....	1,238.29	2,436.28	j'.....	951.27	7,537.34
e.....	2,257.28	2,540.83	k'.....	1,021.33	7,784.75
f.....	3,379.60	2,356.45	l'.....	1,262.50	7,690.24
g.....	3,463.63	2,372.22	m'.....	1,827.59	7,443.82
h.....	3,506.82	2,362.69	n'.....	2,779.72	7,122.95
i.....	3,591.95	2,437.19	o'.....	3,252.60	6,814.81
j.....	3,672.06	2,744.21	p'.....	3,288.70	6,795.91
k.....	3,621.84	2,924.51	q'.....	5,254.32	5,934.25
l.....	3,509.34	3,078.44	r'.....	8,476.42	4,304.02
m.....	3,363.81	3,374.68	s'.....	12,335.80	961.96
p.....	3,280.77	4,168.84			

Approved.

WAR DEPARTMENT, March 30, 1903.

E. ROOT, Secretary of War.

APPENDIX E.

IMPROVEMENT OF RIVERS AND HARBORS IN CONNECTICUT, AND OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

REPORT OF MAJ. CHAS. F. POWELL, CORPS OF ENGINEERS, OFFICER
IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH
OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Pawcatuck River, Rhode Island and Connecticut. | 9. Milford Harbor, Connecticut. |
| 2. New London Harbor, Connecticut. | 10. Housatonic River, Connecticut. |
| 3. Thames River, Connecticut. | 11. Bridgeport Harbor, Connecticut. |
| 4. Connecticut River, below Hartford, Connecticut. | 12. Saugatuck River and Westport Harbor, Connecticut. |
| 5. Harbor of Refuge, Duck Island, Connecticut. | 13. Harbors at Norwalk, Five-Mile River, Stamford, Southport, and Greenwich, Connecticut. |
| 6. Branford Harbor, Connecticut. | 14. Harbor at Coscob and Mianus River, Connecticut. |
| 7. New Haven Harbor, Connecticut. | |
| 8. Construction of breakwaters at New Haven, Connecticut. | |

UNITED STATES ENGINEER OFFICE,
New London, Conn., August 18, 1903.

GENERAL: I have the honor to transmit herewith annual report of the works of river and harbor improvements in my charge for the year ending June 30, 1903.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

E 1.

IMPROVEMENT OF PAWCATUCK RIVER, RHODE ISLAND AND CONNECTICUT.

Previous work of improvement had been applied to the river; nothing had been done under present project to the channel extending across Little Narragansett Bay; navigators complained of the wide flat shoal in the bay.

A survey was made of the channel across the bay and at the mouth of the river, and an examination of the river to Westerly, R. I., the head of navigation. The river channel was found in good condition; it has so remained. The channel in the bay was in poor condition; it limited the drafts of vessels going to Westerly. The obstructed channel was dredged by contract. At May 2, 1903, when the work

was closed, a channel 75 feet in width and of project depth, 10 feet, was excavated from Stonington outer harbor for a distance of 2,500 feet and for 50 feet in width and project depth for 1,100 feet, terminating about 500 feet from the turn into Pawcatuck River, but passing through all the worst part of the shoal. Yardage of material dredged was 28,617; it consisted mainly of hard clay mixed with sand and gravel; rock was encountered at the head of the southern cut; the second cut passed the point of rock, but examination showed that removal of boulders will be necessary to carry the full project depth into the river.

It is proposed to apply the available balance and additional appropriation recommended to the completion of the Little Narragansett Bay channel by its extension and widening, and to a widening of the river channel.

Money statement.

July 1, 1902, balance unexpended	\$9,088.40
June 30, 1903, amount expended during fiscal year	6,546.18
July 1, 1903, balance unexpended	2,542.22
July 1, 1903, outstanding liabilities	.10
July 1, 1903, balance available	2,542.12
{ Amount (estimated) required for completion of existing project	161,360.60
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$12,000.00
For maintenance of improvement	3,000.00
	15,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1871	\$10,000.00
June 10, 1872	10,000.00
March 3, 1873	10,000.00
June 23, 1874	10,000.00
March 3, 1875	10,000.00
August 5, 1886	12,000.00
August 11, 1888	10,000.00
September 19, 1890	16,600.00
July 13, 1892	3,800.00
August 18, 1894	6,000.00
June 3, 1896	15,000.00
March 3, 1899	15,000.00
June 13, 1902	9,000.00
	137,400.00
December 5, 1895, deposit to credit of the United States Treasurer	399.99
Total	137,000.01

CONTRACT IN FORCE.

Contractor: Hartford and New York Transportation Company.
Date of contract, emergency: November 29, 1902.
Date of beginning work: December 1, 1902.
Date of expiration: May 2, 1903.
Rate: 18 cents per cubic yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments by river from Westerly.

Articles.	Tons.
Coal.....	104,179
Lumber.....	8,270
Miscellaneous.....	8,950
Total	116,899

E 2.

IMPROVEMENT OF NEW LONDON HARBOR, CONNECTICUT.

* * * The prices for dredging during the earlier part of the year being more than those prevailing when the survey was made and project prepared, the yardage of the different sections was recomputed; character of material to be dredged reexamined; specifications drawn to secure completion of essential parts of the authorized project, with the right of including small and unimportant widenings and extensions of the channel if the cost permitted; the work advertised at a favorable time for completion within eighteen months and contract made. Work was begun on the last day of the fiscal year and is now being prosecuted at a daily progress of about 4,000 cubic yards. The completed channel is to have a ruling width of 400 feet, except at the basin formed by Winthrop cove, an arm of the main harbor, where the width is to be about 250 feet; the order of prosecution of the work requires a channel 100 feet wide and of full length to be first made; this partial channel is now completed up to the principle deep-vessel wharf.

An examination was made of Winthrop cove, as required, with a view of securing a depth of 30 feet on the lines of the survey on which the improvement project is based.

It is proposed to apply the available balance in completing the 100-foot width channel and its widening and to apply the appropriation recommended in completion of the whole work.

Money statement.

July 1, 1902, balance unexpended.....	\$25,000.00
Amount appropriated by sundry civil act approved March 3, 1903.....	60,000.00
	85,000.00
June 30, 1903, amount expended during fiscal year.....	1,269.71
July 1, 1903, balance unexpended.....	83,730.29
July 1, 1903, outstanding liabilities.....	1,029.88
	82,700.46
July 1, 1903, balance available.....	82,700.46
July 1, 1903, amount covered by uncompleted contracts.....	137,739.09
{ Amount (estimated) required for completion of existing project.....	60,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	60,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

June 13, 1902	\$25,000.00
March 3, 1903	60,000.00
Total	85,000.00

CONTRACT IN FORCE.

Name of contractor: Morris & Cumings Dredging Company.

Date of contract: May 28, 1903.

Date of approval: June 19, 1903.

Date of beginning work: June 30, 1903.

Date of expiration: January 1, 1905.

Rate: 9 $\frac{1}{4}$ cents per cubic yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments by water.

Articles.	Tons.	Articles.	Tons.
Coal	357,797	Iron and steel	1,498
Lumber	20,413	Oil	9,081
Timber	9,830	Wood pulp	80
Stone	3,250	Steamboat freight	477,047
Brick	2,019	Miscellaneous	9,700
Lime	190		
Cement	2,100	Total	893,756
Sand	740		

Number of passengers, 657,827.

E 3.

IMPROVEMENT OF THAMES RIVER, CONNECTICUT.

Bartlett cross-over, a wide flat shoal, and which limited the depths of coal and other vessels bound for Allyns Point, the upstream end of the authorized 16-foot channel, was surveyed for selecting the best line for a deepened channel. Dredging was done on this line; 15,915 cubic yards were excavated, mostly of light material, giving thereby the project channel 16 feet by 200 feet wide through the shoal and permitting that draft to be carried at mean low tide to Allyns Point. Two range targets on each side of the river to mark the middle line of the channel were established and maintained. Surveys of the channel above Allyns Point showed existence of the authorized depth, 14 feet, but at some places of less than the full width of 200 feet. It is proposed to apply the available balance in widening this channel, repair retaining walls or dikes, maintain the Bartlett cross-over channel, and remove obstructive rock in the channel at Norwich, Conn.

Money statement.

July 1, 1902, balance unexpended	\$15,074.32
June 30, 1903, amount expended during fiscal year	4,152.67
July 1, 1903, balance unexpended	10,921.65
July 1, 1903, outstanding liabilities	55.00
July 1, 1903, balance available	10,866.65
Amount (estimated) required for completion of existing project	34,100.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$10,000.00
For maintenance of improvement	8,000.00
	18,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1821	\$150	August 2, 1882	\$35,000
March 2, 1829	150	July 5, 1884	25,000
July 4, 1836	10,000	August 5, 1886	22,500
July 7, 1838	10,000	August 11, 1888	50,000
March 3, 1837	20,000	September 19, 1890	20,000
June 23, 1866	10,000	July 13, 1892	30,000
March 3, 1867	72,000	August 18, 1894	12,500
March 3, 1871	15,000	June 3, 1896	12,000
June 10, 1872	10,000	March 3, 1899	20,000
June 18, 1878	10,000	June 13, 1892	15,000
March 3, 1879	12,000		
June 14, 1880	22,500	Total	463,800
March 3, 1881	30,000		

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Compiled from reports furnished by shippers and receivers.]

Receipts and shipments by river.

Articles.	Tons.	Articles.	Tons.
Coal	296,860	Wood pulp	325
Lumber	21,070	Fertilizer	920
Timber	720	Steamboat freight	86
Brick, lime, and cement	2,100	Miscellaneous	28,138
Sand	950		
Iron	3,500	Total	355,074
Steel rails	405		

Number of passengers, 13,955.

E 4.

IMPROVEMENT OF CONNECTICUT RIVER BELOW HARTFORD,
CONNECTICUT.

Dredging channels through the river bars was continued until October 24, 1902, when a channel of navigable width and project depth was completed. The order of the work was generally from near Hartford downstream, the shoaler bars being at the upper end. The appropriation item for the Connecticut River, in the river and harbor act of 1902, included a provision for removal of obstructions at mouth of the Salmon River, a small tributary of the lower Connecticut. The obstruction consisted of a wide flat sand shoal; a channel was dredged through it into Salmon River.

Details of the dredging, June to October, 1902, are:

Locality.	Length of channel.	Width.	Depth.	Number of cubic yards.	Material.	Classification.
Hartford upper bar	850	50	10			
Hartford lower bar	1,800	75	10	5,628	Sand or gravel	Maintenance.
Clay Banks bar	1,800	50	10.5	5,449	Sand or clay	Do.
Press Barn bar	1,400	75	11	14,249	Sand	Do.
Two Piers bar	510	50	10.5	10,707	Sand or gravel	Do.
Dividend bar	1,200	50	11	5,404	Sand	Do.
Pistol Point bar	850	75	10	5,985	do	Do.
Sears Shoal bar	2,800	50	10	13,579	do	Do.
Salmon River	700	75	8.5	3,958	do	New work.
Potash bar	1,800	75	10.5	13,712	do	Maintenance.
Chester Creek bar	500	75	11	3,410	do	New work.
Total				82,081		

In the spring of 1903 urgent requests were made by the river transportation interests for dredging. It was found by an examination that the bar channels, especially the upstream ones, had already so filled as to interfere with navigation and to promise a practical suspension of the more important river traffic if dredging was not resumed at once. The work was promptly begun on an open market agreement and proposals advertised for a contract continuance, and contract made. The dredging for same width of channel will not be so extensive as in the previous season, the lower river bar channels being in better condition than in 1902. Hartford bar having been dredged in May and a late heavy freshet partly filling the channel, the bar was redredged in June.

Details of the dredging, May and June, 1903, are:

Locality.	Length of chan- nel.	Width.	Depth	Number of cubic yards.	Material.	Classification.
Hartford upper bar	500	75	10		Sand or gravel	Maintenance.
Hartford lower bar	1,800	50	12	17,373	Sand	Do.
Press Barn bar	1,450	25	11	6,347	do	Do.
Dividend bar	1,550	50	12	9,827	do	Do.
Pistol Point bar	2,100	25	11	7,241	do	Do.
May and June, 1903				40,288		
June to October, 1902				82,081		
Total				122,369		

It is proposed to apply the available balance and appropriation recommended in keeping the river channel open this summer and late next spring and for work at Hartford dike and jetties at mouth of the river.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended.....	\$30,075.45
June 30, 1903, amount expended during fiscal year.....	14,422.90
July 1, 1903, balance unexpended.....	15,652.55
July 1, 1903, outstanding liabilities.....	2,079.09
July 1, 1903, balance available.....	13,573.46
July 1, 1903, amount covered by uncompleted contracts.....	6,612.26
Amount (estimated) required for completion of existing project.....	100,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$30,000.00
For maintenance of improvement.....	10,000.00
	40,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

EMERGENCIES IN RIVER AND HARBOR WORKS (ACT OF JUNE 6, 1900).

July 1, 1902, balance unexpended.....	\$1,867.02
June 30, 1903, amount expended during fiscal year.....	1,867.02

APPROPRIATIONS.

July 4, 1836.....	\$20,000.00	July 5, 1884.....	\$35,000.00
March 1, 1848.....	3,471.57	March 3, 1885.....	4,745.43
July 11, 1870.....	20,000.00	August 5, 1886.....	26,250.00
March 3, 1871.....	35,000.00	August 12, 1888.....	10,000.00
June 10, 1872.....	40,000.00	September 19, 1890.....	12,500.00
March 3, 1873.....	20,000.00	July 13, 1892.....	20,000.00
June 23, 1874.....	20,000.00	August 18, 1894.....	20,000.00
March 3, 1875.....	20,000.00	June 3, 1896.....	20,000.00
August 14, 1876.....	20,000.00	March 3, 1899.....	20,000.00
June 20, 1878.....	4,203.00	May 24, 1902, amount allotted.....	2,000.00
June 18, 1878.....	30,000.00	June 13, 1902.....	30,000.00
March 3, 1879.....	10,000.00		
June 14, 1880.....	10,000.00		
March 3, 1881.....	30,000.00	Total.....	528,170.00
August 2, 1882.....	45,000.00		

CONTRACTS IN FORCE.

Name of contractor: Hartford and New York Transportation Company.
Date of contract, emergency: June 12, 1902.
Date of beginning work: May 31, 1902.
Date of completion: October 24, 1902.
Rate: 11.9 cents per cubic yard.

Name of contractor: Hartford and New York Transportation Company.
Date of contract, emergency: June 1, 1903.
Date of beginning work: June 1, 1903.
Rate: 11.45 cents per cubic yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

Compiled by C. C. Goodrich, general manager, Hartford and New York Transportation Company.]

Receipts and shipments, Saybrook Point to Hartford.

Articles.	Tons.	Articles.	Tons.
Coal	335,000	Lime, cement, brick, tile, and pipe...	12,000
Lumber, piles, poles, and railroad ties	48,818	Steamboat freight	125,000
Stone	50,000	Total	570,818

Number of passengers, 65,896.

During spring freshets barges load to 13-foot draft. The summer draft is from 9 to 10 feet. The size of vessels has doubled since Government improvement at Saybrook Point and channels on upper river.

C. C. GOODRICH, *General Manager.*

E 5.

IMPROVEMENT OF HARBOR OF REFUGE, DUCK ISLAND, CONNECTICUT.

No operations were conducted, from lack of funds.

During the year 1900 1,707 vessels were reported as seeking the harbor for refuge. The deeper part of the harbor is open to south-east storms. It is proposed to apply the appropriation recommended to repairs of the section of the western breakwater built in 1898 and to the projected breakwater east of Duck Island.

Money statement.

July 1, 1902, balance unexpended	\$48.89
July 1, 1903, balance unexpended	48.89
(Amount (estimated) required for completion of existing project	349,540.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$122,000.00
For maintenance of improvement	3,000.00
	125,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

September 19, 1890	\$25,000
July 13, 1892	35,000
August 17, 1894	30,000
June 3, 1896	24,000
June 6, 1900 (allotment)	202
Total	114,202

E 6.

IMPROVEMENT OF BRANFORD HARBOR, CONNECTICUT.

Hydrographic survey was made for furnishing information for contract specifications. The yardage for the improvement whose completion is required at a limiting cost of \$5,000 was found to be nearly 40,000. Contract proposals were advertised for at a time for favorable rates and in connection with proposals for similar work at Milford, Conn. The only bid received for the Branford Harbor work was 25 cents per cubic yard, which was rejected as it would have made the cost of the work about \$10,000, or much in excess of the limiting cost. Correspondence was subsequently had with dredging contractors about undertaking the work for the amount available. Some of these looked into the matter, but none would take the contract. It is judged that 25 cents is a reasonable price for the Branford dredging, according to prevailing rates for similar jobs.

It is proposed to apply the available balance and any additional appropriation which may be made in completing the work.

Money statement.

July 1, 1902, balance unexpended	\$5,000.00
June 30, 1903, amount expended during fiscal year	202.01
July 1, 1903, balance unexpended	4,797.99
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATION.

June 13, 1902	\$5,000.00
---------------------	------------

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

Freight received by water.

Articles.	Tons.
Coal	13,853
Iron	6,011
Molding sand and clay	3,922
Lumber	1,650
Total	25,436

E 7.

IMPROVEMENT OF NEW HAVEN HARBOR, CONNECTICUT.

Work under continuing contract in progress at the beginning of the year was continued until completion, on March 20, 1903. The amount removed under this contract during the year was 1,130,763 yards. The work was devoted to widening to 400 feet the 20-foot channel from the

outer end to Long wharf, and thence to Tomlinson Bridge to 300 feet. The 16-foot and 20-foot anchorage basins were completed and a small amount removed from the northeast corner of the 12-foot anchorage basin in front of the East street sewer. A final examination of the dredged channels by means of a submerged sounding bar and instrumental locations was made and a few lumps or ridges formed within channel lines were removed before closing of contract.

The following details the work done:

Location.	Cubic yards dredged.
Main channel:	
At lower end.....	352,609
Opposite 16-foot basin.....	142,626
In front of docks.....	31,413
Total for main channel.....	526,648
12-foot basin in front of sewer.....	17,944
16-foot basin.....	162,821
20-foot basin.....	423,350
Total for the year.....	1,130,763
Total amount removed under this contract.....	3,206,832

A survey was made of the main entrance to the harbor south of the dredged channel and at and outside of opening between breakwaters and a good entrance channel of full depth found.

Surveys, including special examinations at certain parts, were made to the Grand avenue bridges of the Quinnipiac and Mill rivers, which empty into the head of New Haven Harbor proper, and contract entered into for extension of the harbor improvement to the rivers named, as authorized by act of June 13, 1902, and under projects approved January 27 and March 7, 1903. * * * Work under the contract was begun May 26, 1903, at the south end of section III in Mill River, and continued until the close of the fiscal year. A total of 32,893 cubic yards was removed. The rate of progress attained at the end of the year promised early completion, to which the available balance of funds is to be applied.

Attention is called, as authorized, to the commercial need of greater capacity of channel in the Quinnipiac River from Tomlinson Bridge north to or near the Ferry Street Bridge (section I above). South of Tomlinson Bridge the improved channel is 20 feet deep and 400 feet wide, except for a short length next to the bridge, where the width is 300 feet. This channel, 20 feet by 300 feet, should be extended for accommodation of existing traffic to very near the Ferry Street Bridge. The estimated cost for it additional to that of its present authorized improvement, namely, channel 12 feet by 200 feet, is \$62,000. For deepening the channel named to 20 feet, without any widening, the cost would be about \$40,000. The call for the extension of the 20-foot channel is for benefit of traffic of the extensive wire works located on the Quinnipiac River, next below Ferry Street Bridge, and for other interests in prospect. The wire works receive, or try to receive, pig iron or steel billets and coal in deep vessels. Some of the cargoes are transferred to barges at New York, others come direct to New Haven and are partly lightered there, and the vessels, when not drawing more than 17 or 18 feet, taken up to the works after waiting for a good high tide and being hauled by tugs over the shoal bottom. It is stated that the wire works also ship product under difficulty in heavy barges

and deep vessels. Unimproved lands along the water front between the bridges named are adapted for industrial plants and manufacturing sites, but for them the situation is such that water transportation is about necessary.

Money statement.

July 1, 1902, balance unexpended	\$102,475.87
Amount appropriated by sundry civil act approved March 3, 1903	63,073.90
June 30, 1903, amount expended during fiscal year	165,549.27
	98,504.34
July 1, 1903, balance unexpended	67,044.93
July 1, 1903, outstanding liabilities	4,682.86
July 1, 1903, balance available	62,362.07
July 1, 1903, amount covered by uncompleted contracts	46,756.05
Amount (estimated) required for completion of existing project	57,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	62,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

August 30, 1852	\$6,000.00	August 11, 1888	\$15,000.00
July 11, 1870	15,000.00	September 19, 1890	15,000.00
March 3, 1871	40,000.00	July 13, 1892	15,000.00
June 10, 1872	35,000.00	August 18, 1894	10,000.00
March 3, 1873	25,000.00	June 3, 1896	10,000.00
March 3, 1875	10,000.00	March 3, 1899	50,000.00
June 18, 1878	25,000.00	June 6, 1900	50,000.00
March 3, 1879	15,000.00	March 3, 1901	50,000.00
June 14, 1880	15,000.00	June 28, 1902	67,000.00
March 3, 1881	15,000.00	March 3, 1903	63,073.90
August 2, 1882	30,000.00		
July 5, 1884	10,000.00	Total	606,073.90
August 5, 1886	20,000.00		

CONTRACTS IN FORCE.

Name of contractor: John T. Regan.

Date of contract: June 28, 1899.

Date of approval: July 20, 1899.

Work begun: December 8, 1899.

Date of completion: March 20, 1903.

Rates: 6 cents per cubic yard within time limits; 3 cents thereafter.

Name of contractor: William H. Taylor.

Date of contract: May 2, 1903.

Date of approval: May 11, 1903.

Work begun: May 26, 1903.

Date of expiration: January 2, 1904.

Rates: 15 to 35 cents per cubic yard, according to section.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Reported by J. R. Winchell, collector of customs.]

Foreign:		
Value of imports		\$303,833.76
Revenue receipts, duties on imports		93,236.74
Foreign vessels:		
Entered		62
Cleared		41
Total		103
Domestic vessels:		
Entered		776
Cleared		746
Total		1,522

Receipts and shipments by water.

Articles.	Tons.	Articles.	Tons.
Coal	1,346.903	Miscellaneous building material	12,280
Lumber and piling	54,198	Petroleum products	7,178
Lath and shingles	963	Fertilizer material	3,850
Steel billets, pig and scrap iron	23,505	Wood pulp	817
Steel products	5,808	Powder	339
Oysters, seed oysters, and clams	52,319	General merchandise	176,838
Shells	55,359	Miscellaneous merchandise via regular boats from New York	307,856
Sand and clay	29,361	Total	2,086,990
Plaster and cement	7,855		
Brick	1,511		
Bluestone	550		

E 8.

CONSTRUCTION OF BREAKWATERS AT NEW HAVEN, CONNECTICUT.

Contract was awarded for trimming or repairing the present structures and extending the west breakwater. A light was maintained at the unfinished end of the west breakwater.

It is proposed to apply the available balance to the contract work, making the extension about 400 feet, and apply the additional appropriation recommended in further extension of the west breakwater. The estimated additional amount for completion of the west breakwater to the length named in the approved project is \$385,000.

The breakwaters provide a harbor of refuge, which is much used, furnish an outer anchorage for vessels bound to and from New Haven, and help protect the harbor entrance from fillings; 44,725 vessels were reported as having been sighted from the light-house at the east breakwater as passing the locality during the calendar year 1902.

Money statement.

July 1, 1902, balance unexpended	\$44,565.89
June 30, 1903, amount expended during fiscal year	1,052.70
July 1, 1903, balance unexpended	43,512.69
July 1, 1903, outstanding liabilities	35.57
July 1, 1903, balance available	43,477.12
{ Amount (estimated) required for completion of existing project	1,272,134.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	300,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

March 3, 1879.....	\$30,000	September 19, 1890.....	\$120,000
June 14, 1880.....	30,000	July 13, 1892.....	120,000
March 3, 1881.....	60,000	August 18, 1894.....	125,000
August 2, 1882.....	60,000	June 3, 1896.....	100,000
July 5, 1884.....	40,000	June 13, 1902.....	44,000
August 5, 1886.....	75,000		
August 11, 1888.....	75,000	Total.....	879,000

E 9.

IMPROVEMENT OF HARBOR AT MILFORD, CONNECTICUT.

The act of June 13, 1902, appropriated \$15,000 for completion of this improvement by dredging 90,000 cubic yards according to a plan and estimate published in House Document No. 280, Fifty-sixth Congress, first session, and on pages 1356–1363, Annual Report of the Chief of Engineers for 1900. Contract proposals, together with ones for similar work at Branford Harbor, Connecticut, were advertised for at a time for favorable rates. The only bid received for the Milford Harbor work was 22.5 cents per cubic yard, which was rejected, as the contract consideration would exceed the limiting cost. A hydrographic survey was then made for redetermining the yardage, which was found to be 161,500. The completion of the improvement according to this amount of dredging, including cost of inspection and administration, would require an additional appropriation of \$25,000. The cost would be materially diminished by omitting or greatly decreasing the area of the 6-acre anchorage basin and by not extending the 6-foot channel to the north end of the upper harbor.

It is proposed to reserve the available balance for further action by Congress.

Money statement.

July 1, 1902, balance unexpended.....	\$15,000.00
June 30, 1903, amount expended during fiscal year.....	266.89
July 1, 1903, balance unexpended.....	14,733.11
July 1, 1903, outstanding liabilities.....	12.84
July 1, 1903, balance available.....	14,720.27
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	10,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.....	

APPROPRIATIONS.

June 10, 1872.....	\$1,500	August 2, 1882.....	\$5,000
June 23, 1874.....	5,000	August 11, 1888.....	5,000
March 3, 1875.....	13,000	September 19, 1890.....	2,500
June 18, 1878.....	10,000	June 13, 1902.....	15,000
June 14, 1880.....	5,000		
March 3, 1881.....	100	Total.....	62,100

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Collected by agent of United States Engineer Office, New London, Conn.]

Receipts and shipments by water.

Articles.	Tons.
Coal.....	2,108
Oysters.....	10,368
Shells.....	2,070
Total.....	14,534

REPORT OF G. E. VERRILL, JUNIOR ENGINEER.

I respectfully submit an estimate of the yardage required for completion of the project at Milford Harbor, Connecticut. This estimate is based on the survey made last week, a tracing of which is forwarded under separate cover. The soundings, about 600 in number, were all located by transit, and I think are accurate. I am very sorry to say that the yardage greatly exceeds the original estimate of 90,000 cubic yards. The only satisfactory explanation which would account for so large an increase is that this estimate was based on insufficient data. I have gone over my figures very carefully, and am confident that they are essentially correct. The yardage in the main channel outside of the breakwater could be reduced by about 2,000 yards by making a slight bend in the channel, as shown on the tracing in blue, but I hardly think it would be advisable, on account of this small saving in yardage, to make a bend in the channel, as vessels would be very apt to strike the bank on the east side, especially if it were not well buoyed. In the basin and the 10-foot channel I have allowed for no expansion, as the material is almost entirely sand and gravel, and the scow measurement would be practically the same as the prism measurement. I have also reduced the allowance for leeway to as small an amount as I think safe, and have only figured on 1 on 1 slopes.

* * * * *

Very respectfully, yours,

G. E. VERRILL,
Junior Engineer.

Maj. C. F. POWELL,
Corps of Engineers, U. S. Army,
New London, Conn.

Estimate of yardage required to complete project at Milford Harbor, Connecticut.

Locality.	Prism measure- ment.	Slopes 1 on 1.	6 inches for leeway	5 percent for ex- pansion.	Total.
Main channel, 10 feet deep, 100 feet wide, 3,200 feet long.....	28,702	2,000	2,315	(b)	33,017
Basin (exclusive of channel), 10 feet deep; area, 25,400 square yards.....	65,183	2,475	3,800	(b)	71,458
Main channel, 6 feet deep, 90 feet wide, 3,600 feet long.....	48,508	4,800	6,000	2,715	57,018
Total.....	137,393	9,275	12,115	2,715	161,478

^aChannel outside of breakwater, 9,725 cubic yards, allowing 2 feet cutting bank wherever dredging is required.

^bSand and gravel; no expansion.

E 10.

IMPROVEMENT OF HOUSATONIC RIVER, CONNECTICUT.

During April, 1903, 400 tons of riprap were delivered and placed on the breakwater at mouth of the river, the greater portion on the outer 300 feet and remainder distributed where needed for a distance

of several hundred feet inshore. A considerable quantity of old stone which had been displaced was recovered and replaced, thereby putting the work in a good state of repair.

Contracts were made for dredging the entrance channel to the river and the river-bar channels; 5,832 cubic yards were removed from the outer-bar channel, giving the project depth and width in full; the dredging work was distributed over a channel length of one-half mile; the portions dredged aggregated about 1,000 feet in length. Work at the river bars, begun in June, 1903, was in progress at end of the fiscal year. Up to that time 11,800 cubic yards were removed from Mill and Camp Meeting bars. At the former named place the channel made was to project dimensions, and at the latter one to project depth and 75 feet width. The dredgings from the river bars were dumped in deep holes and slack-water places along the shore where not likely to be washed back into the channel.

It is proposed to apply the available balance in maintaining the dredged channels as far as it permits after reserving about \$9,000 for application at Stratford dike when sufficient funds are appropriated to warrant its completion.

Money statement.

July 1, 1902, balance unexpended	\$19,016.31
June 30, 1903, amount expended during fiscal year	1,420.00
July 1, 1903, balance unexpended	17,596.31
July 1, 1903, outstanding liabilities	3,486.20
July 1, 1903, balance available	14,110.11
July 1, 1903, amount covered by uncompleted contracts	3,712.00
(Amount (estimated) required for completion of existing project.....	37,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$20,000.00
For maintenance of improvement	10,000.00
	30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

March 3, 1871.....	\$15,000	August 5, 1886.....	\$5,000
June 10, 1872.....	15,000	August 11, 1888.....	35,000
March 3, 1873.....	10,000	September 19, 1890.....	35,000
June 23, 1874.....	10,000	July 13, 1892.....	20,000
March 3, 1875.....	5,000	August 18, 1894.....	25,000
June 18, 1878.....	5,000	June 3, 1896.....	25,000
June 14, 1880.....	2,000	March 3, 1899.....	15,000
March 3, 1881.....	2,000	June 13, 1902.....	10,000
August 2, 1882.....	2,000		
July 5, 1884.....	2,500	Total	238,500

CONTRACTS IN FORCE.

Name of contractor: John P. Randerson.
Date of contract, emergency: June 9, 1903.
Date of beginning work: June 9, 1903.

Date of completion: June 18, 1903.
 Rate: 25 cents per cubic yard.
 Name of contractor: John P. Randerson.
 Date of contract, emergency: June 22, 1903.
 Date of beginning work: June 17, 1903.
 Date of expiration: September 23, 1903.
 Rate: 16 cents per cubic yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Collected by agent of United States engineer office, New London, Conn.]

Receipts and shipments by water at Stratford, Conn.

Articles.	Tons.
Coal.....	1,229
Shells.....	5,752
Total.....	6,981

Receipts by water at Derby and Shelton, Conn.

Articles.	Tons.
Coal.....	30,304
Sand.....	1,717
Miscellaneous.....	1,791
Total.....	33,812

E 11.

IMPROVEMENT OF BRIDGEPORT HARBOR, CONNECTICUT.

Dredging under continuing contract in force at beginning of the fiscal year was continued throughout the year with from one to three dredges. The work was applied to the completion of the main 18-foot channel inside the inner breakwater, and to dredging the western half of the channel outside thereof, a portion of the 18-foot anchorage, and the channels at Black Rock Harbor. A total of 266,619 yards were removed during the year, of which 130,056 were removed from the Black Rock channels and the remainder from Bridgeport Harbor proper; small amounts of dredging were done in the Pequonnock River, next below the new railroad bridge, to facilitate the passage of vessels between the new piers, and in Johnsons Creek when the weather was unfavorable for work on the main channel. At Black Rock the main channel was completed and also the channels in Cedar Creek to the head of navigation in both branches, and work was begun in the Burr Creek channel with a hydraulic dredge, material being pumped ashore behind earth levees on the meadows to the east of the channel; about half the length of this channel was completed in such manner. All of the dredging this year was at 2.5 cents per yard, the time limit for earning the second appropriation for the improvement

at the base rate of 5 cents per cubic yard having expired July 28, 1901.

The following details the work done:

Location.	Cubic yards	Remarks.
18-foot channel:		
Adjacent to 18-foot basin	28,943	Completed.
From inner beacon southward	48,964	Section 150 feet wide by one-half mile long completed.
18-foot anchorage	55,815	Section about 130 feet wide completed.
Johnsons Creek	546	
Pequonnock River	2,295	Below new railroad bridge.
Black Rock Har bor:		
9-foot main channel	20,454	Completed.
Cedar Creek	58,951	Do.
Burr Creek	50,651	1,117 cubic yards, scow measurement, remainder in prism.
Total for the year	266,619	
Total to date under present project and contract.	871,547	

A contract was made for repairs and extension to the old breakwater at south end of Fayerweather Island and to Jetty No. 4 on its west shore. Work under this contract was begun November 5, 1902; suspended from December 10, 1902, to March 13, 1903, on account of severe weather, and completed on April 30, 1903. A total of about 2,424 tons of riprap stone were delivered and placed and 165.79 square yards of paving laid; the island breakwater was thereby extended northward about 100 feet to close a breach in the bank and repaired by means of riprap for a distance of about 300 feet, and various small places throughout its length were repaired. Jetty No. 4 was raised from 1 to 3 feet in height and extended about 50 feet. In addition to the contract works, surveys of portions of the harbor were made, sections of the harbor lines were identified at the request of riparian owners, and inspections made of permit structures and reported encroachments beyond harbor lines or on the channels.

It is proposed to apply the available balance and the recommended appropriation to first completing the main channel and the channel in Burr Creek, and subsequently to the completion of the entire project and maintaining the improvements already made.

Money statement.

July 1, 1902, balance unexpended	\$107,001.31
June 30, 1903, amount expended during fiscal year	18,681.48
July 1, 1903, balance unexpended	88,319.83
July 1, 1903, outstanding liabilities	5,418.78
July 1, 1903, balance available	82,901.05
July 1, 1903, amount covered by uncompleted contracts	82,901.05
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	10,000.00

APPROPRIATIONS.

July 4, 1836.....	\$10,000	July 5, 1884.....	\$5,000
August 30, 1852.....	10,000	August 5, 1886.....	30,000
March 3, 1871.....	20,000	August 11, 1888.....	10,000
June 20, 1872.....	40,000	September 19, 1890.....	20,000
March 3, 1873.....	30,000	July 13, 1892.....	20,000
June 23, 1874.....	20,000	August 18, 1894.....	10,000
March 3, 1875.....	15,000	June 3, 1896.....	28,000
August 14, 1876.....	10,000	March 3, 1899.....	50,000
June 18, 1878.....	10,000	June 6, 1900.....	50,000
March 3, 1879.....	10,000	March 3, 1901.....	50,000
June 14, 1880.....	10,000		
March 3, 1881.....	10,000	Total.....	468,000
August 2, 1882.....	10,000		

CONTRACTS IN FORCE.

Name of contractor: Hughes Bros. & Bangs.

Date of contract: July 31, 1899.

Date of approval: August 25, 1899.

Date of beginning work: July 9, 1900.

Date of expiration: Indefinite.

Rates: For dredging, base rate 5 cents per cubic yard; for riprap stone in place, \$2 per ton.

Name of contractor: E. S. Belden & Sons.

Date of contract, emergency: October 22, 1902.

Date of beginning work: November 5, 1902.

Date of completion: April 30, 1903.

Rates: For riprap stone in place, \$2.40 per ton; for paving, \$3 per square yard.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Furnished by collector of customs, Bridgeport, Conn.]

Foreign:

Value of imports.....\$640,052.69

Revenue receipts, duties on imports.....190,569.48

Foreign vessels:

Entered.....43

Cleared.....44

[Collected by agent of United States engineer office, New London, Conn.]

Receipts and shipments by water.

Articles.	Tons.
Coal.....	465,892
Lumber.....	67,415
Pikes, logs, ties, and cord wood.....	2,628
Pig and scrap iron.....	17,234
Steel billets.....	7,225
Iron pipe.....	2,530
Broken stone, riprap, and flagging.....	17,434
Granite.....	3,780
Sand.....	31,643
Clay.....	18,447
Brick.....	6,128
Cement.....	8,970
Petroleum products.....	8,178
Acid.....	4,307
Empty acid carboys.....	1,059
Plumbago.....	1,000
Crude brimstone.....	1,152
Oysters.....	40,230
Oyster shells.....	9,306
Powder.....	78
Rock plaster.....	2,000
Tar.....	495
Iron oxide.....	898
Fireproofing material.....	12,000
Miscellaneous merchandise.....	578
Steamboat freight.....	128,217
Total.....	880,056

Number of passengers, 154,035.

E 12.

IMPROVEMENT OF SAUGATUCK RIVER AND WESTPORT HARBOR,
CONNECTICUT.

No improvement operations were conducted during the year, from lack of sufficient funds. Completion of the project requires further removal of bowlders and dredging to project dimensions at the channel opposite Westport.

Money statement.

July 1, 1902, balance unexpended	\$176.70
June 30, 1903, amount expended during fiscal year	1.95
July 1, 1903, balance unexpended	174.75
{ Amount (estimated) required for completion of existing project	5,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

May 20, 1826	\$400	March 2, 1867	\$2,500
March 2, 1827	1,500	July 11, 1870	2,500
April 30, 1830	28	July 13, 1892	7,000
July 4, 1836	1,000	August 17, 1894	3,000
July 4, 1836	3,000	June 3, 1896	3,000
May 3, 1837	3,734		
July 7, 1838	4,782	Total	32,444

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Collected by agent of United States engineer office, New London, Conn.]

Receipts and shipments by water.

Articles.	Tons.	Articles.	Tons.
Coal	8,179	Produce	3,000
Timber	200	Miscellaneous	1,150
Green skins	450		
Dyeing and tanning material	400	Total	13,379

E 13.

IMPROVEMENT OF HARBORS AT NORWALK, FIVE-MILE RIVER,
STAMFORD, SOUTHPORT, AND GREENWICH, CONNECTICUT.

Contract was made for dredging at these harbors, and work prosecuted at two or three of them at a time, beginning at Greenwich and Five-mile on December 24, 1902, and closing at Southport on June 6, 1903.

(A) NORWALK HARBOR.

A total of 78,492 cubic yards of material and a 1½-ton bowlder were removed from channel. Of the dredging, 13,520 cubic yards were from the turn in channel at Keyzers Point, in the lower harbor, and

the remainder from the main channel between Dorlans dock upstream to the railroad bridge at South Norwalk. Dredging of 13,011 yards from near the dock front, at a cost of \$2,313, is properly chargeable to maintenance, having been removed from portion of the channel formerly dredged. A channel of project depth and width now exists from the outer end to the highway bridge at South Norwalk. From this bridge to the railroad bridge the channel was dredged to a width of about 50 feet and on a line between the two western draw openings of the bridges. It is proposed to apply the available balance and the appropriation recommended in completing the channel of the approved project between and near the two bridges at South Norwalk and maintaining the channel dredged in previous years from South Norwalk to Norwalk. Estimate is made of \$4,000 for works of improvement and \$2,000 for maintenance of channel from South Norwalk to Norwalk.

Money statement.

July 1, 1902, balance	\$80.25
November 8, 1902, allotted act June 13, 1902	13,833.00
	13,893.25
June 30, 1903, amount expended during fiscal year	13,208.96
July 1, 1903, balance unexpended	684.27
July 1, 1903, outstanding liabilities	27.00
July 1, 1903, balance available	657.27

(B) FIVE-MILE RIVER.

Dredging at this place under the combined contract, suspended from January 18 to March 3, 1903, on account of winter and scarcity of coal, was completed April 25, 1903. A total of 28,928 cubic yards of material were removed, including 10,450 cubic yards, at a cost of \$1,626, shoaling in from the channel since previous operations in 1899.

* * * Most of the redredging was done at the mouth of the harbor and in the upper section, which had been previously dredged to 60 feet width. Surveys were made showing existing condition of the channel and late improvements along the water front, and portions of the established harbor line were identified at request of riparian owners.

It is proposed to apply the appropriation recommended, \$5,000, in widening the dredged channel where now less than project width and \$1,000 for maintenance of the dredged channel.

Money statement.

July 1, 1902, balance	\$58.41
November 8, 1902, allotted act June 13, 1902	4,500.00
	4,558.41
June 30, 1903, amount expended during fiscal year	4,542.34
July 1, 1903, balance available	16.07

(C) STAMFORD HARBOR.

Dredging under the combined contract was finished March 21, 1903; 31,706 cubic yards of material and 72.34 tons of bowlders were removed, all from the East Branch. * * *

It is proposed to apply the available balance and the appropriation recommended, \$75,000, to widening the East Branch channel where now of limited width, including removal of bowlders, redredging portions of the West Branch where shoaled, and dredging the basin at its head, thereby completing the adopted project. The estimates include \$3,000 for maintenance of channels already dredged.

Money statement.

July 1, 1902, balance.....	\$804.58
November 8, 1902, allotted act June 13, 1902.....	10,111.00
June 30, 1903, amount expended during fiscal year.....	10,715.53
	10,049.00
July 1, 1903, balance unexpended.....	666.53
July 1, 1903, outstanding liabilities.....	.10
July 1, 1903, balance available.....	666.43

(D) SOUTHPORT HARBOR.

Under the combined contract dredging was begun May 11 and completed June 6, 1903. The channel was dredged to full project dimensions for about 350 feet from its outer end, and above this point to full project depth, and with widths varying from 75 to 90 feet, up to a point about 200 feet inside the outer end of the breakwater, the total length of dredged channel being about 2,200 feet. Previous to the dredging above described, the breakwater, which had been damaged by storms, was repaired in April, 1903, at a cost for work of \$150.

It is proposed to resume the dredging work this season in widening the dredged channel at its head, and to apply the appropriation recommended, \$9,000, in completing the dredging project and removing two points of obstructive ledge rock.

Money statement.

July 1, 1902, balance.....	
November 8, 1902, allotted act June 13, 1902.....	\$8,889.00
June 30, 1903, amount expended during fiscal year.....	7,545.54
July 1, 1903, balance unexpended.....	1,343.46
July 1, 1903, outstanding liabilities.....	148.83
July 1, 1903, balance available.....	1,194.63

(E) GREENWICH HARBOR.

Dredging under the combined contract was completed March 14, 1903. The channel was dredged to project dimensions for about 1,400 feet from its outer end and for 1,000 feet farther, or to the steamboat dock, to project depth 9 feet and 45 feet in width. Upstream from this point the 6-foot project channel was redredged and widened to 80 feet, or to a point about 230 feet from the upper end of the turning basin, and the southern and western sides of the basin were dredged to project depth, thereby giving a channel of navigable width to the upstream docks. The total yardage was 43,573, of which amount 4,700 cubic yards were for maintenance.

It is proposed to apply the appropriation recommended (\$7,000) for work of improvement in completing the project, and \$1,000 in maintaining the channel already dredged.

Money statement.

July 1, 1902, balance	\$469.98
November 8, 1902, allotted, act June 13, 1902	6,667.00
June 30, 1903, amount expended during fiscal year	7,136.98
	7,113.64
July 1, 1903, balance available	23.84

Money statement (consolidated).

July 1, 1902, balance unexpended	\$45,198.17
June 30, 1903, amount expended during fiscal year	42,459.50
July 1, 1903, balance unexpended	2,733.67
July 1, 1903, outstanding liabilities	175.93
July 1, 1903, balance available	2,557.74
{ Amount (estimated) required for completion of existing project	137,700.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$97,000.00
For maintenance of improvement	7,000.00
	104,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Norwalk Harbor.

June 10, 1872	\$10,000	August 5, 1886	\$3,000
March 3, 1873	10,000	August 11, 1888	3,000
June 23, 1874	10,000	September 19, 1890	4,000
March 3, 1875	7,000	August 18, 1894	15,000
June 18, 1878	6,000	June 3, 1896	10,000
March 3, 1879	10,000	March 3, 1899	2,000
June 14, 1880	5,000	June 13, 1902 (allotted)	13,833
March 3, 1881	5,000		
August 2, 1882	5,000	Total	123,833
July 5, 1884	5,000		

Five Mile River.

August 11, 1888	\$5,000	March 3, 1899	\$2,500
September 19, 1890	5,000	June 13, 1902 (allotted)	4,500
July 13, 1892	5,000		
August 18, 1894	2,500	Total	27,000
June 3, 1896	2,500		

Stamford Harbor.

August 5, 1886	\$10,000	June 3, 1896	\$10,000
August 11, 1888	5,000	March 3, 1899	6,000
September 19, 1890	5,000	June 13, 1902 (allotted)	10,111
July 13, 1892	15,000		
August 18, 1894	10,000	Total	71,111

Southport Harbor.

March 2, 1829	\$6,097.00	June 14, 1880	\$2,500.00
July 3, 1832	4,490.23	March 3, 1881	2,500.00
July 4, 1836	1,500.00	August 2, 1882	3,000.00
March 3, 1837	1,000.00	June 13, 1902 (allotted)	8,889.00
July 11, 1870 (allotted)	500.00		
March 3, 1875	5,000.00	Total	40,476.23
August 14, 1876	5,000.00		

^a From appropriation of \$44,000 for Norwalk, Five Mile River, Stamford, Southport, and Greenwich harbors.

Greenwich Harbor.

June 3, 1896	\$6,000
June 13, 1902 (allotted)	8,687
Total	12,687

CONTRACT IN FORCE.

Name of contractor: John P. Randerson.
 Date of contract: November 29, 1902.
 Date of beginning work: December 24, 1902.
 Date of completion: June 6, 1903.
 Rates:

For dredging at Norwalk, 16 cents per cubic yard.
 For dredging at Five-mile, 14 cents per cubic yard.
 For dredging at Stamford, 25 cents per cubic yard.
 For dredging at Southport, 28½ cents per cubic yard.
 For dredging at Greenwich, 14 cents per cubic yard.
 For removal of bowlders, \$10 per ton.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Collected by agent of United States Engineer Office, New London, Conn.]

NORWALK HARBOR.

Receipts and shipments by water.

Articles.	Tons.	Articles.	Tons.
Coal	81,553	Sulphur	100
Lumber	8,244	Silex	6,000
Oysters	40,507	Steamboat freight	35,000
Brick	6,880	Miscellaneous	6,500
Sand and clay	5,141	Total	194,800
Stone	4,000		
Iron	875		

FIVE MILE RIVER.

Receipts and shipments by water.

Articles.	Tons.
Oysters	7,884
Oyster shells	1,644
Clams	100
Total	9,128

STAMFORD HARBOR.

[Furnished by collector of customs at Stamford, Conn.]

Foreign:	
Value of imports	\$131,153.07
Revenue receipts, duties on imports	1,745.55
Foreign vessels:	
Entered	33
Cleared	5
Total	38
Domestic vessels:	
Entered	410
Cleared	844
Total	754

* From appropriation of \$44,000 for Norwalk, Five Mile River, Stamford, Southport, and Greenwich harbors.

Receipts and shipments by water.

Articles.	Tons.	Articles.	Tons.
Coal	66,584	Chalk	3,360
Sand	5,256	Bluestone	1,225
Iron	1,380	Brick	1,625
Stone	680	Heavy spar	1,425
Cord wood	256	Miscellaneous produce	900
Railroad material, miscellaneous	800	Steamboat freight	70,278
Gasoline	112		
Lumber	11,886	Total	166,617
Clay	360		

Number of passengers, 20,000.

SOUTHPORT HARBOR.

No statement obtained for 1902. The yearly tonnage when last reported, 1896, was 25,145.

GREENWICH HARBOR.

Receipts and shipments by water.

Articles.	Tons.	Articles.	Tons.
Coal	27,000	Water pipe	2,500
Lumber	22,500	Cord wood	500
Lath	227	Grain	59
Bluestone and flagging	12,550	Gasoline	107
Sand and gravel	8,000	Oysters	15
Crushed stone	7,300	Steamboat freight	40,000
Brick	7,000		
Cement, mortar, and plaster	3,276	Total	131,034

Number of passengers, 3,000.

E 14.

IMPROVEMENT OF HARBOR AT COSCOB AND MIANUS RIVER,
CONNECTICUT.

No improvement operations were conducted during the year from lack of funds. * * *

Tonnage of this waterway was reported for 1897 as 61,500. It has continually decreased since that year. For 1901 the tonnage was 8,062 and a little less for last year. The waterway is not considered worthy of further improvement.

Money statement.

July 1, 1902, balance unexpended	\$70.31
June 30, 1903, amount expended during fiscal year	5.50
July 1, 1903, balance unexpended	64.81
Amount (estimated) required for completion of existing project	35,000.00

APPROPRIATIONS.

July 13, 1892.....	\$7,000
August 18, 1894.....	4,000
June 3, 1896.....	8,000
Total.....	19,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

[Collected by agent of United States Engineer Office, New London, Conn.]

Received and shipped by water.

Articles.	Tons.
Coal.....	4,850
Sand.....	400
Stone.....	1,200
Oysters.....	1,070
Total.....	7,520

APPENDIX F.

IMPROVEMENT OF RIVERS AND HARBORS IN NEW YORK ON LONG ISLAND SOUND AND ON THE SOUTHERN SHORE OF LONG ISLAND, OF HUDSON RIVER AND HARBORS THEREON, AND OF THE HARLEM AND EAST RIVERS, NEW YORK.

REPORT OF COL. AMOS STICKNEY, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Port Chester Harbor, New York. | 9. Newtown Creek, New York. |
| 2. Mamaroneck Harbor, New York. | 10. Browns Creek, New York. |
| 3. Larchmont Harbor, New York. | 11. Great South Bay, New York. |
| 4. Echo Bay Harbor, New York. | 12. Hudson River, New York. |
| 5. Bronx River and East Chester Creek, New York. | 13. Saugerties Harbor, New York. |
| 6. Harbors at Fort Jefferson, Huntington, Glencove, Flushing Bay, Canarsie Bay, and Sag Harbor, New York. | 14. Harbors at Rondout and Peekskill, New York. |
| 7. East River and Hell Gate, New York. | 15. Wappinger Creek, New York. |
| 8. Harlem River, New York. | 16. Removing sunken vessels or craft obstructing or endangering navigation. |

HARBOR LINES.

- | | |
|---|---|
| 17. East River at North Brother Island, New York. | 20. East Branch of Newtown Creek at Brooklyn, New York. |
| 18. East River at Lawrence Point and Berrian Island, New York. | 21. Hudson River at Albany, New York. |
| 19. East River between East Thirteenth and East Eighteenth streets, New York. | 22. Hudson River from Fort Lee to Guttenburg, New Jersey. |

UNITED STATES ENGINEER OFFICE,
New York City, July 17, 1903.

GENERAL: I have the honor to forward herewith annual reports upon works of river and harbor improvements in my charge for the fiscal year ending June 30, 1903.

Very respectfully, your obedient servant,

AMOS STICKNEY,
Colonel, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

F. I.

IMPROVEMENT OF PORT CHESTER HARBOR, NEW YORK.

Detailed description of the harbor and of projects for its improvement are printed in the Report of the Chief of Engineers for 1897, page 1084.

Under contract with John and Joseph McSpirit, dated May 25, 1903, dredging the channel for maintenance has been in progress. On June 30, 1903, 9,385 cubic yards of material had been removed.

The channel has shoaled slightly.

The available funds will be applied to maintaining the channel.

Money statement.

July 1, 1902, balance unexpended	\$7, 140. 29
June 30, 1903, amount expended during fiscal year	91. 90
July 1, 1903, balance unexpended	7, 048. 39
July 1, 1903, outstanding liabilities	1, 970. 85
July 1, 1903, balance available.....	5, 077. 54
July 1, 1903, amount covered by uncompleted contracts.....	3, 029. 15
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	2, 000. 00

APPROPRIATIONS.

By act of—		By act of—	
June 10, 1872	\$12, 000	June 3, 1896	\$5, 000
August 2, 1882	15, 000	March 3, 1899	25, 000
August 11, 1888	5, 000	June 13, 1902	5, 000
September 19, 1890	5, 000		
July 13, 1892	5, 000	Total	82, 000
August 18, 1894	5, 000		

CONTRACT IN FORCE.

Name of contractor: John and Joseph McSpirit.

Date of contract: May 25, 1903.

Date of approval: June 10, 1903.

Date of commencement: July 12, 1903.

Date of completion: January 12, 1904.

COMMERCIAL STATISTICS.

Vessels employed in trade in 1902.

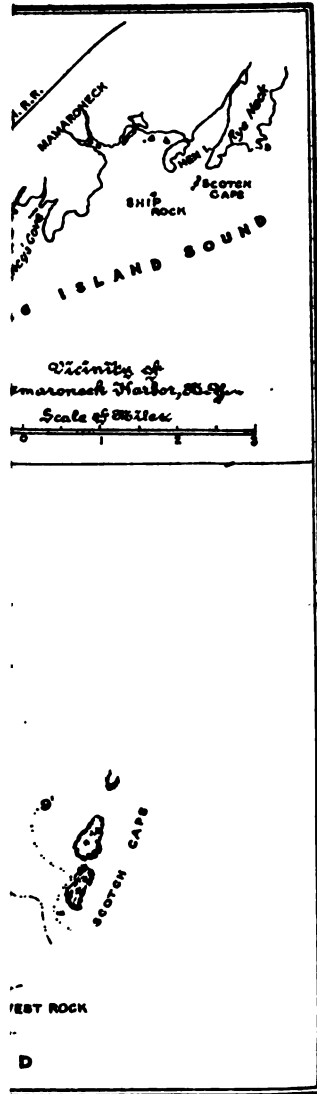
Class.	Trips made.	Tonnage.	Draft.
Steam	2, 000	20 to 300	Feet. 4 to 10
Sail	150	4 to 700	4 to 12
Barges, etc.....	600	100 to 800	5 to 10

2. The second part of the document focuses on the implementation of the proposed changes. It details the steps involved in the process, from the initial planning stage to the final execution. The author highlights the challenges faced during the implementation and provides solutions to overcome them. The text also discusses the role of different departments in the process and the importance of communication and collaboration.

3. The third part of the document presents the results of the implementation. It includes a detailed analysis of the data collected and a comparison of the results with the initial goals. The author discusses the successes and failures of the implementation and provides recommendations for future improvements. The text also includes a summary of the key findings and conclusions.

4. The fourth part of the document provides a conclusion and a final summary of the findings. It reiterates the importance of maintaining accurate records and the need for continuous improvement. The author expresses confidence in the results of the implementation and hopes that the findings will be useful to other organizations facing similar challenges.



Freight received and shipped by water, 1902.

	Tons.
Fuel.....	57,000
Building material.....	90,000
General merchandise.....	90,000
Total.....	237,000

Estimated value of 1902 tonnage, \$900,000.

F 2.**IMPROVEMENT OF MAMARONECK HARBOR, NEW YORK.**

Detailed description of the harbor and project for its improvement are printed in the Report of the Chief of Engineers for 1900, page 1381.

Contract was made with John and Joseph McSpirit, dated May 25, 1903, for the removal of about 18,500 cubic yards of mud, sand, and gravel, at 27 cents per cubic yard. No work was done during the year.

The appropriation of June 13, 1902, will be applied to widening the channel to 100 feet, in accordance with project, and redredging where necessary.

Money statement.

July 1, 1902, balance unexpended	\$6,039.60
June 30, 1903, amount expended during fiscal year	21.60
July 1, 1903, balance unexpended	6,018.00
July 1, 1903, amount covered by uncompleted contracts.....	5,000.00
(Amount (estimated) required for completion of existing project.....	5,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—	
August 2, 1882	\$15,000
June 3, 1896	10,000
March 3, 1899.....	7,000
June 13, 1902	6,000
Total.....	38,000

CONTRACT IN FORCE.

Name of contractor: John and Joseph McSpirit.

Date of contract: May 25, 1903.

Date of approval: June 10, 1903.

Date of commencement: July 12, 1903.

Date of completion: January 12, 1904.

To dredge 18,500 cubic yards, at 27 cents per cubic yard.

COMMERCIAL STATISTICS.

Freight handled, 1902.

	Tons.
Coal.....	6, 860
Building materials.....	16, 675
General merchandise.....	8, 875
Total.....	32, 410

Vessels engaged in commerce for 1902.

Class.	Number of vessels.	Tonnage.	Draft.
			<i>Feet.</i>
Steamers.....	2	150	7 to 9
Sail vessels.....	2	130	5 to 6
Barges.....	2	250	6 to 9

The value of the commerce for 1902 was \$75,000.

F 3.

IMPROVEMENT OF LARCHMONT HARBOR, NEW YORK.

Detailed description of the harbor and of the present and previous projects for its improvement is printed in Report of the Chief of Engineers for 1900, pages 1383 to 1387.

Work has been in progress under contract with P. Sanford Ross, Incorporated, dated December 17, 1902, removing the Huron Rock breakwater and Huron Rock. Under this contract all the rock in the breakwater, amounting to 2,008 tons, has been removed. The rock was used for repairing and strengthening the new breakwater off Long Beach Point. About one-quarter of Huron Rock has been drilled.

Under a previous project Umbrella breakwater and Huron breakwater were built to lengths of 74 and 64 feet, respectively.

Under the present project the breakwater off Long Beach Point has been built to a length of 1,410 feet, with side slopes of 1 on 1 and top width of 5 feet. Its height is 10 feet above low-water plane. The outer end for a length of 25 feet is 10 feet wide and 14 feet above low water. A light is maintained there by the Light-House Establishment.

The funds available will be applied to the completion and maintenance of the breakwater off Long Beach Point and to the removal of Huron Rock.

Money statement.

July 1, 1902, balance unexpended.....	\$10, 000. 00
June 30, 1903, amount expended during fiscal year.....	2, 165. 26
July 1, 1903, balance unexpended.....	7, 834. 74
July 1, 1903, outstanding liabilities.....	2, 193. 38
July 1, 1903, balance available.....	5, 641. 36
July 1, 1903, amount covered by uncompleted contracts.....	4, 279. 40
(Amount (estimated) required for completion of existing project.....	48, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	48, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

LARCHMONT HARBOR, N.Y.

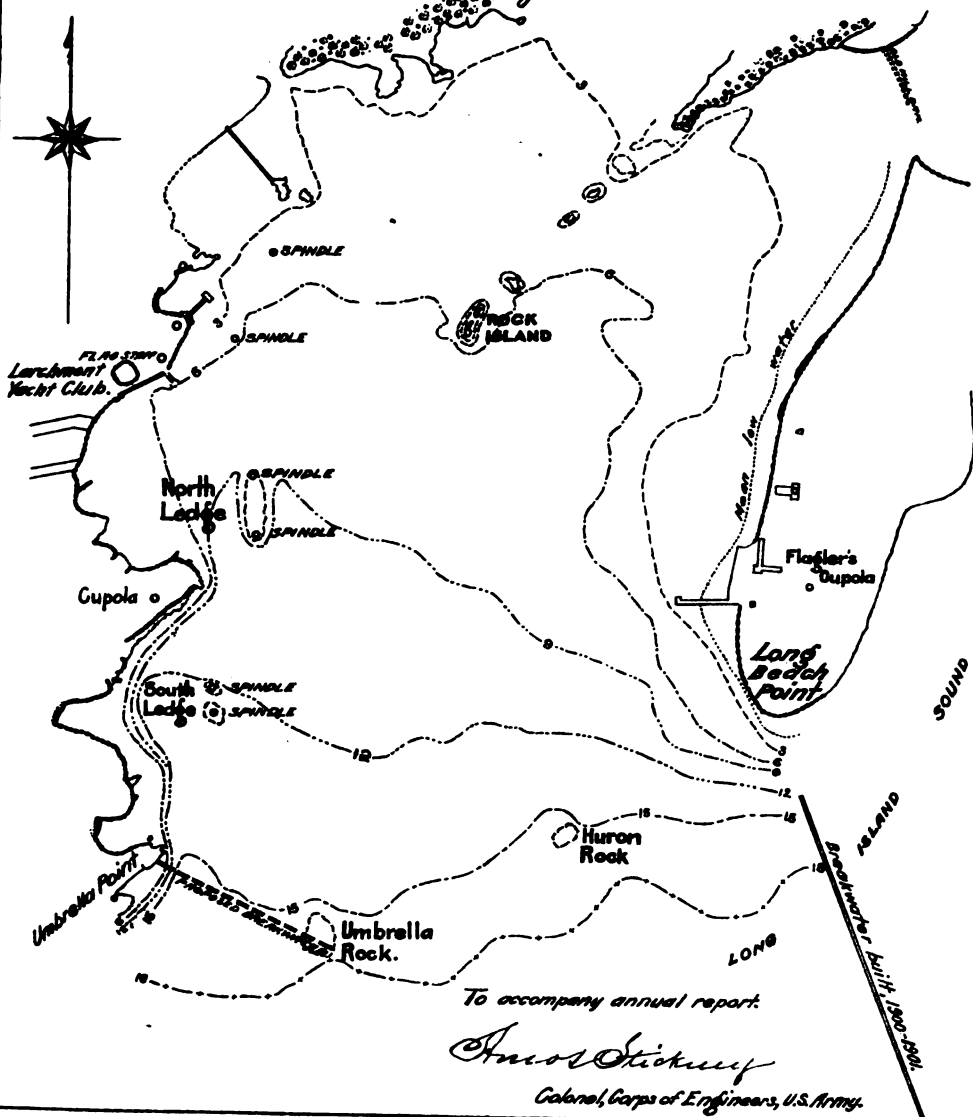
Condition of Improvement,

JUNE 30, 1903.

SCALE:



From survey of 1883.
Mean rise of tide 2 1/2 ft.



APPROPRIATIONS.

By act of—	
September 19, 1890	\$5,000
March 3, 1899	50,000
June 13, 1902	10,000
Total	65,000

CONTRACT IN FORCE.

Name of contractor: P. Sanford Ross, Incorporated.
 Date of contract: December 17, 1902.
 Date of approval: January 2, 1903.
 Date of commencement: February 2, 1903.
 Date of completion: November 30, 1903.
 To remove about 2,300 tons of riprap, at \$2 per ton, and about 336 cubic yards of ledge rock, at \$11 per cubic yard.

COMMERCIAL STATISTICS, 1901.

Number of vessels other than yachts entering harbor of refuge, or for the night, during 1901 (estimated)	850
Draft of such vessels	feet.. 4 to 18
Tonnage of such vessels	tons.. 100 to 500

Freight discharged in Larchmont Harbor in 1901.

Number of cargoes	150
Amount in tons	15,500

Vessels owned by the Larchmont Yacht Club.

[Draft, from 3 to 22 feet; tonnage, from 3 to 600 tons.]

Steamers	86
Schooners	51
Sloops	160
Smaller boats	66
Total	363

Commercial statistics were asked for 1902, but none were received. Many letters were sent to parties supposed to be interested asking for the information.

F 4.

IMPROVEMENT OF HARBOR AT ECHO BAY, NEW YORK.

* * * * *

Work has been in progress during the past year under a contract with P. Sanford Ross, dated December 17, 1902, for the removal of about 1,100 cubic yards of rock from Start rock, Sheepshead reef, including Devoe rock. All the drilling on Sheepshead reef and Devoe rock is completed, and on June 30, 1903, 351 cubic yards of rock had been removed.

With the funds on hand it is proposed to complete the removal of these rocks to the projected depth, including the point on Start rock if it can be located.

Money statement.

July 1, 1902, balance unexpended	\$17,000.00
June 30, 1903, amount expended during fiscal year	335.07
July 1, 1903, balance unexpended	16,664.93
July 1, 1903, outstanding liabilities	3,510.00
July 1, 1903, balance available	13,154.93
July 1, 1903, amount covered by uncompleted contracts.....	7,790.00

APPROPRIATIONS.

By act of—

June 18, 1878.....	\$10,000
March 3, 1879.....	3,000
June 14, 1880.....	3,000
March 3, 1881.....	3,000
August 2, 1882.....	3,000
Total.....	22,000
June 13, 1902.....	17,000
Total.....	39,000

CONTRACT IN FORCE.

Name of contractor: P. Sanford Ross, Incorporated.
Date of contract: December 17, 1902.
Date of approval: January 2, 1903.
Date of commencement: April 1, 1903.
Date of completion: November 30, 1903.
To remove about 1,100 cubic yards of ledge rock, at \$10 per cubic yard, prism measurement.

COMMERCIAL STATISTICS.

	Tons.
General merchandise	40,000
Coal.....	25,000
Building material	30,000
Farm produce.....	4,000
Total.....	99,000

The value of commerce for 1902 was estimated at \$500,000.

F 5.

IMPROVEMENT OF BRONX RIVER AND EAST CHESTER CREEK, NEW YORK.

(A) BRONX RIVER, NEW YORK.

Detailed history of this improvement was printed in Report of the Chief of Engineers for 1900, pages 1389 to 1391.

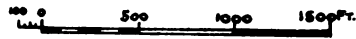
No active operations were in progress during the year. Bids were opened April 25, under specifications issued March 25, 1903. The only bid received was from John and Joseph McSpirit, at 95 cents per cubic

**ECHO BAY,
NEW ROCHELLE HARBOR,
NEW YORK.**

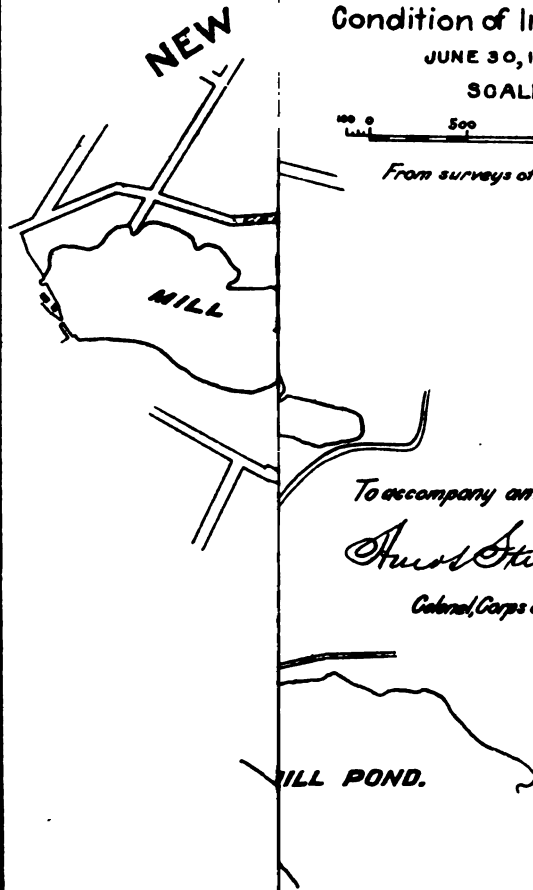
Condition of Improvement,

JUNE 30, 1903.

SCALE:



From surveys of 1875-1879.



To accompany annual report.

August Stickney

Colonel, Corps of Engineers, U.S. Army.

yard. This was rejected as too high, and new bids were advertised for.

Thirteen ledges lying within the projected 50-foot channel above Dongan street, and mostly in the vicinity of Westchester Avenue Bridge and the railroad bridge, have been removed to depths of 6 feet at mean low water. The ledge at the railroad bridge has been removed to depths of from 1 to 2 feet and broken to 4 feet depth, and part of a reef of rocks and boulders near the Dye Works dock and the head of navigation has been removed. The depth of the unimproved channel up to Dongan street is 3 feet or more at mean low water, and the bottom is mud and sand. Above Dongan street depths of from 3 to 6 feet can be carried to the railroad bridge; above the railroad bridge, except where rock has been removed to 6 feet, the unimproved channel is from 0 to 2½ feet in depth. The rock removal required under the project is nearly completed.

The available funds and the appropriation of June 13, 1902, will be applied to removing rock obstruction and to dredging. Unless larger appropriations are made available, the cost of this improvement will be greatly increased and its completion delayed. It is impossible in many cases to get bids for such small amounts, and when they are received they are excessive.

Money statement.

July 1, 1902, balance unexpended	\$1,474.01	
July 17, 1902, allotted from river and harbor appropriation of June 13, 1902	5,000.00	
		\$6,474.01
June 30, 1903, amount expended during fiscal year		19.58
July 1, 1903, balance unexpended		6,454.43
(Amount (estimated) required for completion of existing project		55,985.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:		
For works of improvement	\$55,985.00	
For maintenance of improvement	5,000.00	
		60,985.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.		

APPROPRIATIONS.

By act of—	
June 3, 1896	\$10,000
March 3, 1899	20,000
June 13, 1902, allotment	5,000
Total	35,000

COMMERCIAL STATISTICS.

	Tons.
Coal	\$98,000
Lumber	5,000
Building material	50,000
General merchandise	137
Total	153,137

The above freight is carried in steamers, sailing vessels, and barges, having a tonnage of from 85 to 300 tons and a draft of from 4 to 6 feet.

The value of commerce for 1902 was estimated at \$500,000.

(B) EAST CHESTER CREEK, NEW YORK.

Detailed descriptions of the stream and of the project for improvement are printed in the Report of the Chief of Engineers for 1897, pages 1089-1090, and for 1900, page 1387.

No work was done. Bids were opened April 25, under specifications issued March 25, 1903. The only bid received was from John and Joseph McSpirit, who proposed to dredge at 45 cents per cubic yard. This bid was rejected as too high, and new bids were advertised for.

The appropriation of June 13, 1902, is to be applied to maintenance of improvement.

Money statement.

July 1, 1902, balance unexpended	\$98.68
July 17, 1902, allotted from river and harbor appropriation of June 13, 1902.....	3,000.00
	3,098.68
June 30, 1903, amount expended during fiscal year	100.37
July 1, 1903, balance unexpended	2,998.31
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	5,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1873	\$25,000	August 11, 1888	\$5,000
March 3, 1875	12,000	August 18, 1894	12,000
June 18, 1878	10,000	June 3, 1896	10,000
March 3, 1879	3,500	June 13, 1902 (allotment) ..	3,000
June 14, 1880	3,500		
August 5, 1886	10,000	Total	94,000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1902.

Class.	Trips made.	Tonnage.	Draft.
Steam	40	5 to 50	<i>Feet.</i> 6 to 10
Sail.....	6	200 to 3,000	8
Barges.....	186	100 to 200	4 to 9

Freight handled.

	Tons.
Coal.....	59,000
Building material	9,750
General merchandise	31,000
Total.....	99,750

The value of commerce in 1902 was estimated at \$870,500.

F 6.

IMPROVEMENT OF HARBORS AT PORT JEFFERSON, HUNTINGTON, GLENCOVE, FLUSHING BAY, CANARSIE BAY, AND SAG HARBOR, NEW YORK.

(A) PORT JEFFERSON HARBOR.

Detailed descriptions of the harbor and of previous projects are printed in Reports of the Chief of Engineers for 1897, page 1097, and for 1900, page 1393.

This channel has deepened and widened, due to the scour produced by breakwaters, so that there is now practically a channel 12 feet deep and 240 feet wide, except at end of breakwater, where slight shoaling has taken place. Work has been in progress under contract with John P. Randerson, dated June 11, 1903, removing the shoal part. On June 30, 1903, 6,583 cubic yards of material had been removed.

The available balance is to be applied to enlarging the east jetty and to dredging the channel as projected.

Money statement.

July 1, 1902, balance unexpended	\$312.32
August 1, 1902, allotted from river and harbor appropriation of June 13, 1902	9,000.00
	<u>9,312.32</u>
June 30, 1903, amount expended during fiscal year	79.75
July 1, 1903, balance unexpended	9,232.57
July 1, 1903, outstanding liabilities	1,843.16
	<u>7,389.41</u>
July 1, 1903, balance available	6,156.84
July 1, 1903, amount covered by uncompleted contracts	<u>6,156.84</u>
{ Amount (estimated) required for completion of existing project	78,500.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	25,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

For previous project.

By act of—	
March 3, 1871	\$15,000
June 10, 1872	15,000
March 3, 1875	15,000
August 14, 1876	6,000
June 18, 1878	8,000
March 3, 1879	5,000
June 14, 1880	3,000
March 3, 1881	4,000
August 2, 1882	8,000
	<u>\$79,000</u>

For present project.

By act of—	
September 19, 1890	25,000
July 13, 1892	10,000
August 18, 1894	7,500
June 3, 1896	7,500
March 3, 1899	7,500
June 13, 1902 (allotment)	9,000
	<u>66,500</u>
Total	145,500

CONTRACT IN FORCE.

Name of contractor: John P. Randerson.

Date of contract: June 11, 1903.

Date of approval: June 30, 1903.

Date of commencement: August 3, 1903.

Date of completion: December 3, 1903.

For dredging about 28,500 cubic yards material, at 28 cents per cubic yard.

COMMERCIAL STATISTICS.

Vessels employed in trade in 1902.

Class.	Trips made.	Tonnage.	Draft
Steam	1,916	10 to 1,000	Fet.
Sail	2,200	15 to 1,500	3 to 1
Barges	50	100 to 500	6 to 1

Freight handled.

	Total
Coal	7,000
Farm produce	10,000
Building material	17,000
General merchandise	20,000
Total	54,000

(B) HUNTINGTON HARBOR.

Detailed description of the harbor and the projects for improvement is printed in the Report of the Chief of Engineers for 1897, pages 1100 to 1102.

No active operations were in progress. Bids were advertised for under specifications issued March 25, 1903, but no bids were received. Bids have again been advertised for.

The appropriation of June 13, 1902, is to be applied to completing and maintaining the channels by means of dredging.

Money statement.

July 1, 1902, balance unexpended	\$10.94
August 1, 1902, allotted from river and harbor appropriation of June 13, 1902	2,500.00
July 1, 1903, balance unexpended	2,510.94
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	2,500.00

SCALE OF FEET.

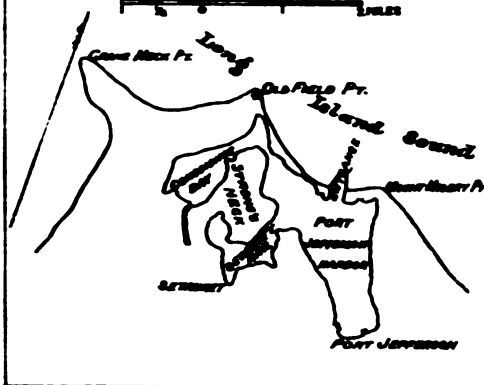
SCALE OF FEET

Photo:-

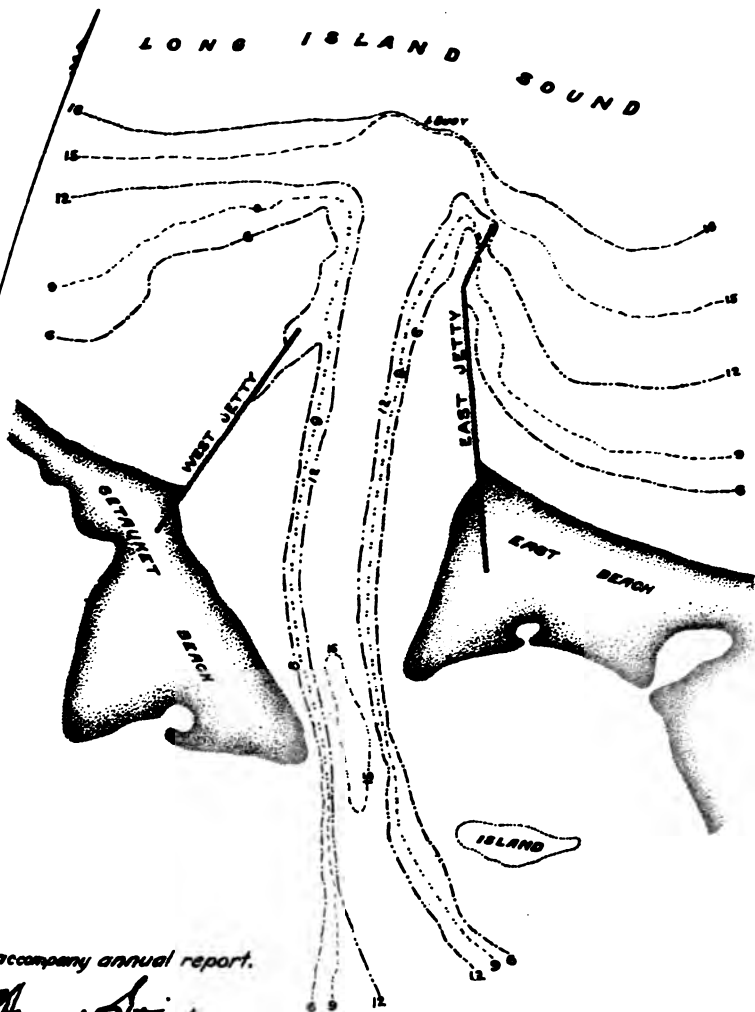
Scuba

THE Council

ART JEFFERSON



LONG ISLAND SOUND



To accompany annual report.

Amos Stickney
Colonel, Corps of Engineers

Colonel, Corps of Engineers.

HARBOR

APPROPRIATIONS.

By act of—		By act of—	
June 10, 1872.....	\$22, 500	March 3, 1899.....	\$7, 500
September 19, 1890.....	10, 000	June 13, 1902 (allotment) ..	2, 500
July 13, 1892.....	5, 000		
August 18, 1894.....	2, 000	Total	54, 500
June 3, 1896.....	5, 000		

COMMERCIAL STATISTICS.

Vessels employed in trade in 1901.

Class.	Trips made.	Tonnage.	Draft.
Steam	700	125 to 250	<i>Feet.</i> 6 to 8
Sail	175	50 to 250	5 to 12
Barges, etc	90	200	5 to 6½

Freight handled.

	Tons.
Coal	9, 000
Building material	20, 000
Grain	5, 000
General merchandise	18, 000
Total	52, 000

The value of the merchandise carried during 1901 was \$875,800.

No commercial statistics could be obtained for 1902, although many letters were sent to parties supposed to be interested asking for the information.

(C) GLENCOVE HARBOR.

Details concerning the harbor and project for improvement are printed in the Report of the Chief of Engineers for 1897, page 1103.

Work of repairing and strengthening the breakwater in accordance with project was commenced under contract with Smith & Robinson. During the year 1,799 tons of riprap were placed in the breakwater under this contract.

The appropriation of June 13, 1902, will be applied to repairing and strengthening breakwater in accordance with project.

Money statement.

August 1, 1902, allotted from river and harbor appropriation of June 13, 1902.....	\$6, 000. 00
June 30, 1903, amount expended during fiscal year	73. 33
July 1, 1903, balance unexpended.....	5, 926. 67
July 1, 1903, outstanding liabilities	1, 412. 22
July 1, 1903, balance available	4, 514. 45
July 1, 1903, amount covered by uncompleted contracts	3, 587. 78
{ Amount (estimated) required for completion of existing project.....	66, 000. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	10, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897,	

APPROPRIATIONS.

By act of—		By act of—	
August 11, 1888	\$20,000	June 3, 1896	\$8,000
September 19, 1890	15,000	June 13, 1902 (allotment) ..	6,000
July 13, 1892	10,000		
August 18, 1894	10,000	Total	69,000

CONTRACT IN FORCE.

Name of contractor: Smith & Robinson.
 Date of contract: May 25, 1903.
 Date of approval: June 10, 1903.
 Date of commencement: July 12, 1903.
 Date of completion: October 12, 1903.
 Furnishing and placing in breakwater 6,360 gross tons of riprap, at 78½ cents per ton.

COMMERCIAL STATISTICS.

A statement of the commerce for the calendar year 1902 was asked for, but was not received. Many letters were sent asking for information as to statistics.

(D) FLUSHING BAY.

Details in reference to this improvement may be found in the Report of the Chief of Engineers for 1897, page 1106.

No work was done during the year. Bids were advertised for under specifications issued March 25, 1903. The only bid received was from the R. G. Packard Company, for 37½ cents per cubic yard. This was rejected as excessive. New bids were advertised for.

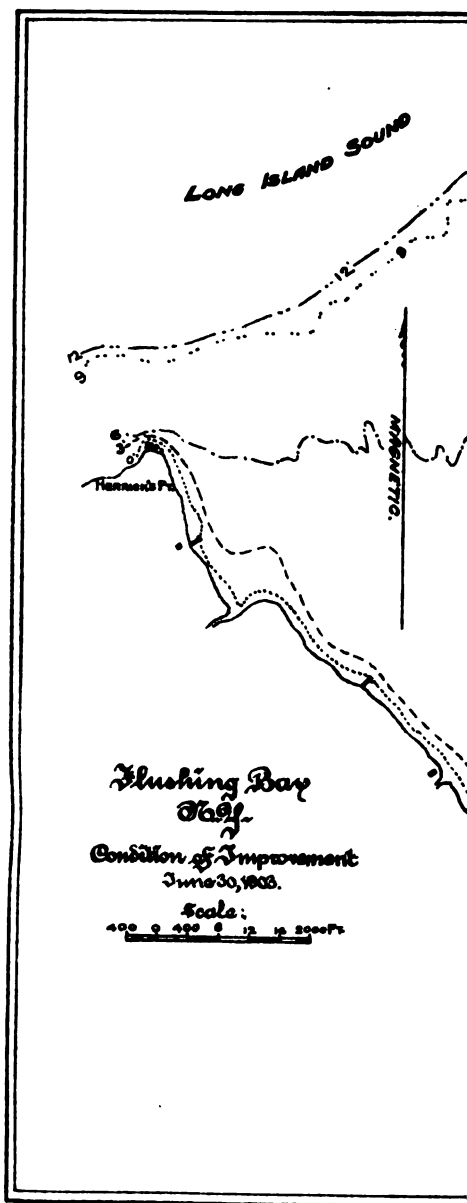
The channel has shoaled and narrowed.

The appropriation of June 13, 1902, is to be applied to maintaining and widening the dredged channel.

A survey is in progress for the purpose of determining what further improvements are needed.

Money statement.

July 1, 1902, balance unexpended	\$459. 47
August 1, 1902, allotted from river and harbor appropriation of June 13, 1902	2,000. 00
July 1, 1903, balance unexpended	2,459. 47
{ Amount (estimated) required for completion of existing project	50,500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	10,000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	



8

1

t

r

o

s
t
r

a

in

J
A

J

{
-
-
-
}

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1879	\$20,000	September 19, 1890	\$20,000
June 14, 1880	15,000	July 13, 1892	10,000
March 3, 1881	10,000	August 18, 1894	4,000
August 2, 1882	5,000	June 3, 1896	4,000
July 5, 1884	10,000	June 13, 1902 (allotment) ..	2,000
August 5, 1886	10,000		
August 11, 1888	15,000	Total	125,000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1901.

Class.	Trips made.	Tonnage.	Draft.
Steam	1,550	100 to 150	<i>Feet.</i> 7 to 7½
Sail vessels	200	150 to 450	6 to 14
Barges, etc	1,200	100 to 1,000	6 to 14

Freight received and shipped by water in 1902.

	Tons.
Coal	57,500
Building material	15,400
Dyewoods	43,000
Farm produce	18,000
General merchandise	43,000
Ice	5,500
Total	182,400

The value of the commerce in 1902 was \$1,613,100.

(F) CANARSIE BAY.

Description of the locality and the project for improvement is printed in the Report of the Chief of Engineers for 1897, page 1114.

No active work was carried on during the year. Bids were advertised for January 20, 1903, but none were received. Bids were again advertised for.

The appropriation of June 13, 1902, is to be applied to widening and maintaining the dredged channels. Unless larger appropriations are made available the cost of this work will be greatly increased and its completion delayed.

Money statement.

July 1, 1902, balance unexpended	\$425.82
August 1, 1902, allotted from river and harbor appropriation of June 13, 1902	5,000.00
	5,425.82
June 30, 1903, amount expended during fiscal year	174.03
	5,251.79
July 1, 1903, balance unexpended	
{ Amount (estimated) required for completion of existing project	23,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	23,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—		By act of—	
June 14, 1880	\$10,000	September 19, 1890	\$5,000
March 3, 1881	5,000	July 13, 1892	5,000
August 2, 1882	3,000	August 18, 1894	2,000
July 5, 1884	5,000	June 3, 1896	10,000
August 5, 1886	10,000	June 13, 1902 (allotment)...	5,000
August 11, 1888	10,000		
		Total	70,000

COMMERCIAL STATISTICS.

The tonnage of oysters and clams was reported for the year 1901 as 450,000 tons, valued at \$2,000,000. Lumber, coal, ice, and brick also made up a large part of the commerce. The amount was not reported.

Commercial statistics for 1902 were called for, but were not received, although letters were sent to many persons supposed to be interested requesting information.

(F) HARBOR AT SAG HARBOR.

* * * * *

For description of locality, project, etc., see Annual Report of the Chief of Engineers for 1903, page 130.

The breakwater is to be built of riprap, in accordance with the present project, to extend from Conklin Point in a north-by-west direction about 1,330 feet, thence in a nearly northwest direction 1,850 feet to the 9-foot curve, making a total length of 3,180 feet. The top is to be 8 feet above mean low water and 5 feet wide; the side slopes are to be 1 on 1.

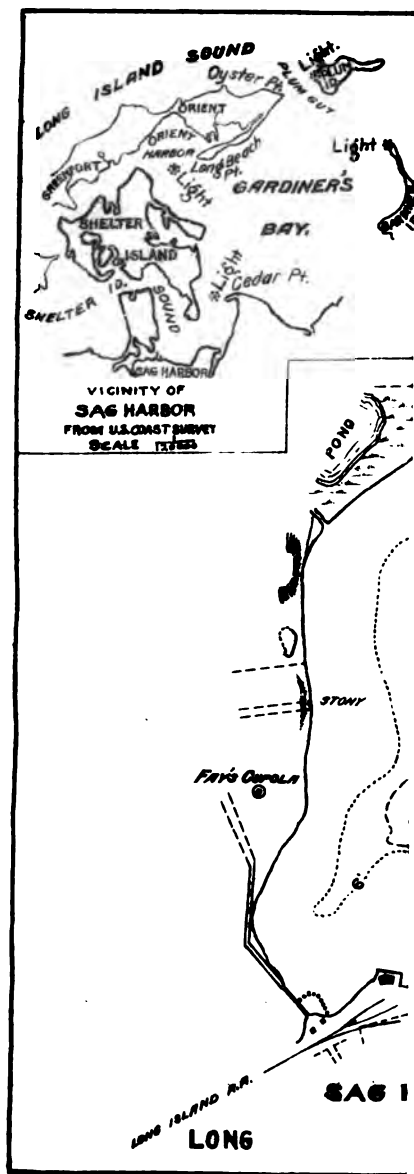
Work has been in progress on this improvement under a contract with Peter Lynam, dated October 17, 1902, to furnish and place from 6,500 to 10,000 gross tons in breakwater at \$1.37 per ton. This contract should have been completed January 31, 1903. The time limit has been waived. Progress on this work has been highly unsatisfactory. On June 30, 1903, only 1,015 tons had been placed in breakwater under above contract.

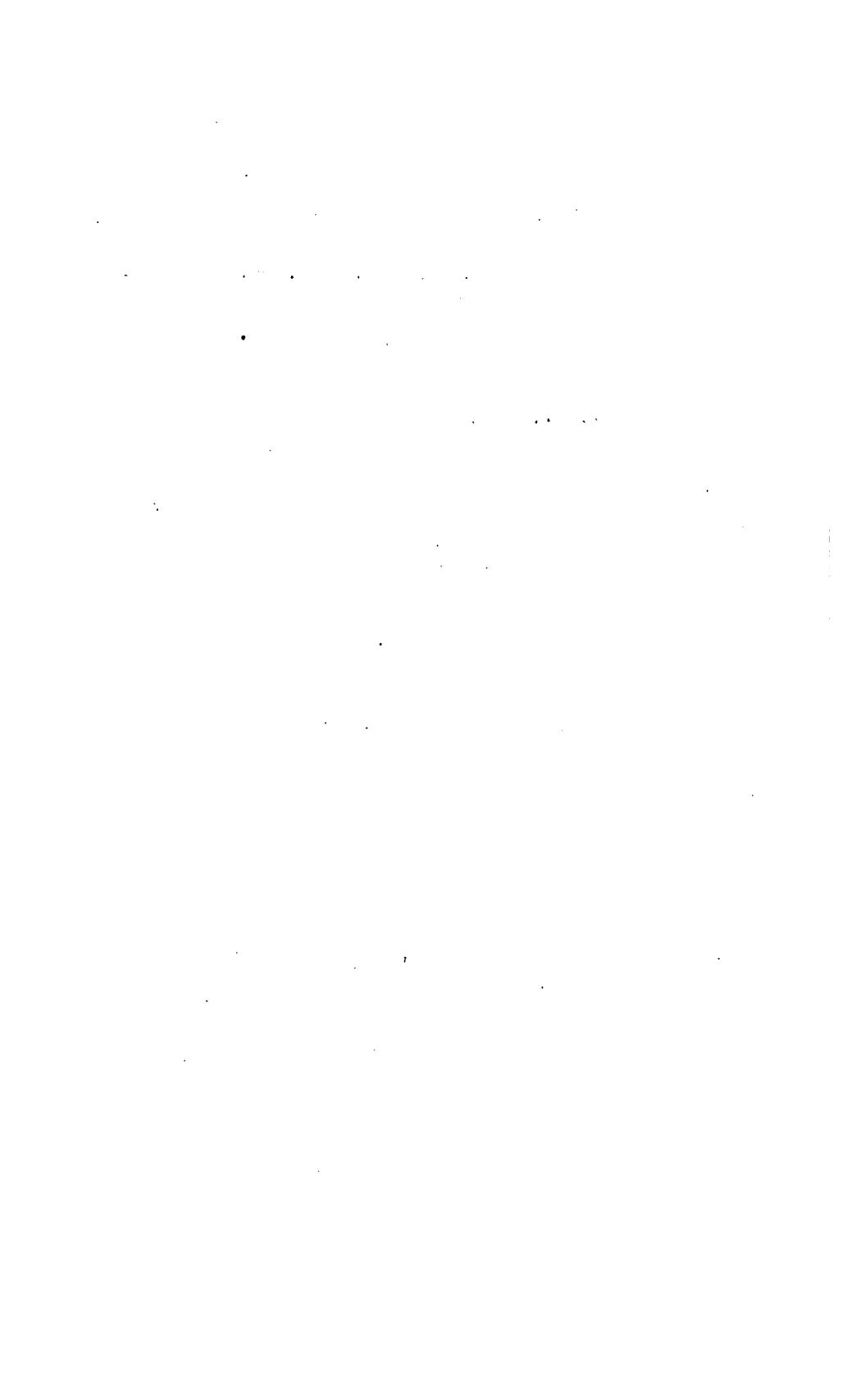
* * * * *

The available funds will be used to continue work in accordance with project.

Money statement.

August 1, 1902, allotted from river and harbor appropriation of June 13, 1902	\$10,000.00
June 30, 1903, amount expended during fiscal year	941.20
July 1, 1903, balance unexpended	9,058.80
July 1, 1903, outstanding liabilities	995.95
July 1, 1903, balance available	8,062.85
July 1, 1903, amount covered by uncompleted contracts	7,646.69
{ Amount (estimated) required for completion of existing project	61,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	61,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	





APPROPRIATION.

By act of—
 June 13, 1902 (allotment)..... \$10,000.00

CONTRACT IN FORCE.

Name of contractor: Peter Lynam.
 Date of contract: October 17, 1902.
 Date of approval: November 11, 1902.
 Date of commencement: December 10, 1902.
 Date of completion: Time limit waived.
 To furnish and place in breakwater between 6,500 and 10,000 gross tons of riprap,
 at \$1.37 per ton.

COMMERCIAL STATISTICS.

Commercial statistics were requested for 1902, but none were received, although many letters were sent to parties supposed to be interested.

F 7.

IMPROVEMENT OF EAST RIVER AND HELL GATE, NEW YORK.

Work was continued at Man-o'-War Rock under a contract entered into with the R. G. Packard Company, and was completed February 27, 1903; 3,663 cubic yards of rock were removed during the year, making the total removed under this contract 23,854 cubic yards.

Work was continued on the reef off Twenty-sixth street under contract with George A. Rogers, and was completed in November. During the fiscal year 444 cubic yards of rock were removed, making the total of 906 cubic yards removed under contract.

Under the same contract work was continued on the reef at Third street, and was completed in September. During the year 95 cubic yards of rock were removed.

The plant laid up at Mill rock was cared for.

* * * * *

With the available funds it is proposed to complete the removal of Shell reef and, if possible, take out Pot rock and portions of the broken rock from Middle reef. The appropriation recommended for fiscal year ending June 30, 1905, will be expended in completing work at the localities included in the project, doing first that which is most urgently needed.

A contract was entered into with the R. G. Packard Company for the removal of Shell reef, but had not been approved at close of year.

Unless larger appropriations are made available the cost of this improvement will be greatly increased, and it will be many years before it can be completed.

Money statement.

July 1, 1902, balance unexpended	\$138,253.15
June 30, 1903, amount expended during fiscal year	39,346.95
July 1, 1903, balance unexpended	98,906.20
{ Amount (estimated) required for completion of existing project.....	905,778.55
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance unexpended July 1, 1903	500,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

APPROPRIATIONS.

By other than river and harbor acts prior to 1852.....	\$13, 861. 59	
Act of—		
August 30, 1852.....	20, 000. 00	
		\$33, 861. 59
July 25, 1868 (allotment).....	85, 000. 00	
April 10, 1869 (allotment).....	176, 841. 45	
July 11, 1870.....	250, 000. 00	
March 3, 1871.....	250, 000. 00	
June 10, 1872.....	225, 000. 00	
March 3, 1873.....	225, 000. 00	
June 23, 1874.....	214, 000. 00	
March 3, 1875.....	250, 000. 00	
August 14, 1876.....	250, 000. 00	
June 18, 1878.....	350, 000. 00	
March 3, 1879.....	250, 000. 00	
June 14, 1880.....	200, 000. 00	
March 3, 1881.....	200, 000. 00	
May 4, 1882.....	50, 000. 00	
August 2, 1882.....	200, 000. 00	
July 5, 1884.....	360, 000. 00	
August 5, 1886.....	112, 500. 00	
August 11, 1888.....	250, 000. 00	
September 19, 1890.....	200, 000. 00	
July 13, 1892.....	150, 000. 00	
August 18, 1894.....	75, 000. 00	
June 3, 1896.....	60, 000. 00	
March 3, 1899.....	250, 000. 00	
June 13, 1902.....	100, 000. 00	
		4, 733, 341. 45
Total.....		4, 767, 203. 04

COMMERCIAL STATISTICS.

The commerce of East River is so intimately connected with that belonging to New York Harbor proper that it is impracticable to make a separate statement of it

F 8.

IMPROVEMENT OF HARLEM RIVER HARBOR, NEW YORK.

Detailed description of the river and projects for improvement is printed in Report of the Chief of Engineers for 1897, page 1019.

Work was carried on under contract with Morris & Cumings Dredging Company, dated April 28, 1903. The channel was redredged in the vicinity of the Second, Third, and Fourth avenues and Macombs Dam bridges; 18,380 cubic yards of material were removed under this contract during the year.

The available funds will be expended in widening and deepening the channel between the Hudson River and Macombs Dam bridge, and the appropriation recommended for fiscal year ending June 30, 1905, will be applied to increasing the dimensions of the channel throughout its entire length, from East to Hudson rivers.

To complete this work in a reasonable time and economically, contracts should be authorized for the balance of the work required under the project.

Many changes have taken place in the river since the last survey, and it is therefore impossible to furnish a map at this time.

Money statement.

July 1, 1902, balance unexpended	\$76, 279. 22
June 30, 1903, amount expended during fiscal year.....	1, 149. 12
July 1, 1903, balance unexpended	75, 148. 10
July 1, 1903, outstanding liabilities	5, 788. 64
July 1, 1903, balance available	69, 359. 46
July 1, 1903, amount covered by uncompleted contracts.....	59, 211. 36
(Amount (estimated) required for completion of existing project.....	1, 380, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	500, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—	
June 23, 1874 (allotment).....	\$11, 000
March 13, 1875.....	10, 000
	\$21, 000
June 18, 1878	300, 000
March 3, 1879.....	100, 000
August 11, 1888	70, 000
September 19, 1890.....	250, 000
July 13, 1892.....	175, 000
August 18, 1894	125, 000
June 3, 1896	125, 000
March 3, 1899.....	100, 000
June 13, 1902	75, 000
	1, 320, 000
Total	1, 341, 000

CONTRACT IN FORCE.

Name of contractor: Morris & Cumings Dredging Company.
 Date of contract: April 28, 1903.
 Date of approval: May 15, 1903.
 Date of commencement: June 4, 1903.
 Date of completion: December 31, 1903.
 Dredging about 200,000 cubic yards, at 32½ cents per cubic yard.

COMMERCIAL STATISTICS.

The commerce of the Harlem River is so intimately connected with that belonging to East River and New York Harbor, that a separate statement of it can not be made.

F 9.

IMPROVEMENT OF NEWTOWN CREEK, NEW YORK.

Details concerning this improvement appear in the Reports of the Chief of Engineers for 1896, pages 760-761, and 1900, page 1411.

No work was done during the fiscal year.

The available funds will be applied to maintenance of the dredged channel.

Money statement.

July 1, 1902, balance unexpended	\$15,285.61
June 30, 1903, amount expended during fiscal year	335.00
July 1, 1903, balance unexpended	14,950.61

APPROPRIATIONS.

By act of—

June 14, 1880	\$10,000
August 2, 1882	15,000
July 5, 1884	20,000
August 5, 1886	37,500
August 11, 1888	25,000
September 19, 1890	35,000
July 13, 1892	35,000
August 18, 1894	20,000
	<u>\$197,500</u>
June 3, 1896	30,000
June 4, 1897	183,000
	<u>213,000</u>
Total	410,500

COMMERCIAL STATISTICS.

Commercial statistics were called for, but only one reply was received. This was from the Standard Oil Company, for the tonnage handled by themselves, and is as follows: 870,741 tons, valued at \$16,559,782.

F 10.

IMPROVEMENT OF BROWNS CREEK, SAYVILLE, LONG ISLAND, NEW YORK.

Detailed description of this improvement is printed in the Report of the Chief of Engineers for 1897, pages 1111 to 1114.

Nothing in furtherance of the project has been done during the year.

The available funds and the appropriations recommended will be applied to extending and maintaining the channel by dredging and repairing jetties.

The jetties at the mouth of this stream are in need of repairs. Some shoaling has also taken place. Great benefit is reported as having resulted from this improvement.

Money statement.

July 1, 1902, balance unexpended	\$372.98
June 30, 1903, amount expended during fiscal year	372.98
(Amount (estimated) required for completion of existing project	18,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$18,000.00
For maintenance of improvement	10,000.00
	<u>28,000.00</u>
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899:	

APPROPRIATIONS.

By act of—

September 19, 1890.....	\$12, 000
July 13, 1892.....	5, 000
August 18, 1894.....	4, 000
June 3, 1896.....	4, 000
March 3, 1899.....	3, 000
Total.....	28, 000

COMMERCIAL STATISTICS.

Vessels employed in trade in 1902.

Class.	Number of vessels.	Tonnage.	Draft.
Steam.....	16	10 to 50	<i>Feet.</i> 3 to 6½
Sail.....	200	2½ to 100	2 to 7
Barges.....	16	5 to 100	1 to 3½

Freight received and shipped by water.

	Tons.
Building material.....	2, 550
Fish and shellfish.....	13, 500
Coal.....	1, 500
Farm produce.....	80
Total.....	17, 630

The value of the commerce in 1902 was \$299,300.

Two new fishing houses were reported as established.

F II.

IMPROVEMENT OF GREAT SOUTH BAY, NEW YORK.

* * * * *

For description of locality and projects for improvement see Annual Report of the Chief of Engineers for 1903, page 134.

Under contract with Kirk, Driscoll & Co., dated October 7, 1902, dredging has been in progress * * *. On June 30, 1903, 46,119 cubic yards of material had been removed.

* * * * *

The channel has been dredged 60 feet wide and 6 feet deep at mean low water from Great South Bay to 80 feet from the harbor lines at the head of the harbor. At the upper part for 300 feet length it was made 100 feet wide to allow vessels to turn about. A channel 200 feet wide and 10 feet deep has been nearly completed through bar C.

The funds available will be expended in carrying out the work proposed under the new project.

This work will be continued under the title "Improving Great South Bay, New York."

Money statement.

July 1, 1902, balance unexpended	\$66,000.00
June 30, 1903, amount expended during fiscal year	7,921.97
July 1, 1903, balance unexpended	58,078.03
July 1, 1903, outstanding liabilities	4,557.89
July 1, 1903, balance available	53,520.14
July 1, 1903, amount covered by uncompleted contracts	49,548.04
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	2,000.00

APPROPRIATIONS.

For first project.

By act of—	
September 19, 1890	\$15,000
July 13, 1892	8,000
August 18, 1894	4,000
June 3, 1896	13,000
Total	40,000

For present project.

By act of—	
June 13, 1902	66,000
Total for both projects	106,000

CONTRACT IN FORCE

Name of contractor: Kirk, Driscoll & Co.

Date of contract: October 7, 1902.

Date of approval: November 6, 1902.

Date of commencement: November 28, 1902.

Date of completion: May 16, 1904.

To dredge 140,000 cubic yards in Great South Bay, at 23½ cents per cubic yard, and 120,000 cubic yards in Patchogue River, at 23 cents per cubic yard.

COMMERCIAL STATISTICS.

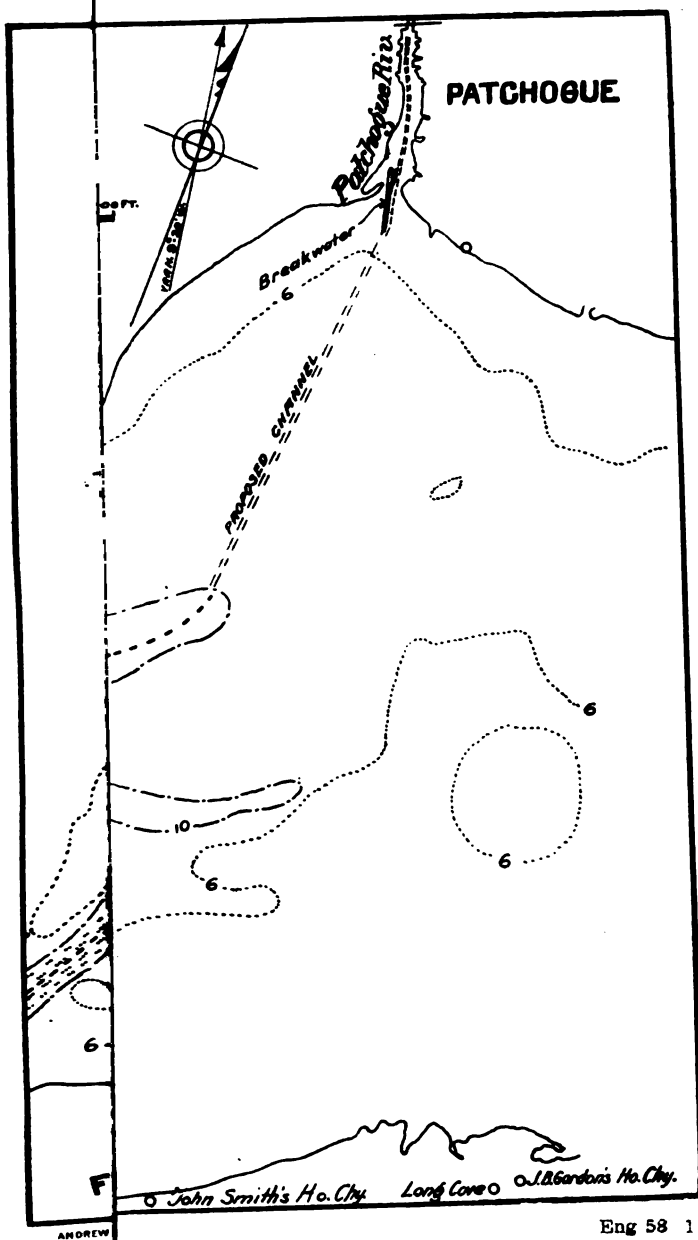
Vessels employed in trade in 1902.

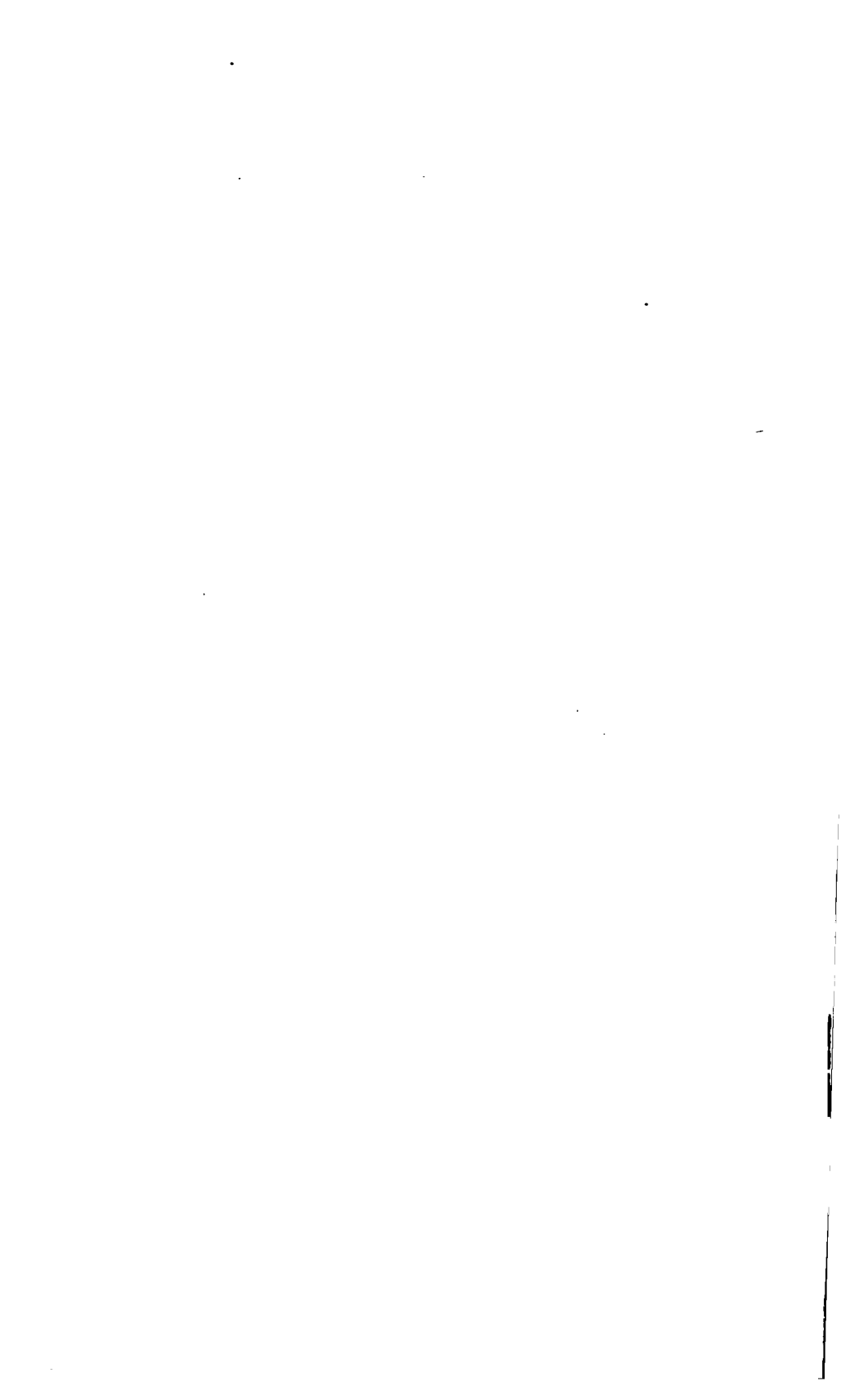
Class.	Trips made.	Tonnage.	Draft.
Steam	1,900	20 to 70	Feet. 3 to 5
Sail	8,500	8 to 300	3 to 8
Barges, etc	4,500	30 to 100	2 to 5

Freight handled.

	Tons.
Coal	15,000
Lumber	200,000
Fish and shellfish	5,000
General merchandise	37,500
Total	257,500

The estimated value of the tonnage for 1902 is \$4,000,000.





F 12.

IMPROVEMENT OF HUDSON RIVER, NEW YORK.

At the beginning of the fiscal year dredging, rock removal, and dike construction and repairs were in progress under contracts with Kirk, Driscoll & Co. and the United States Fidelity and Guaranty Company, and contracts for dredging and dike construction and repair were entered into with the Morris & Cumings Dredging Company and Kirk, Driscoll & Co., respectively. The dredging and rock removal under contract with Kirk, Driscoll & Co. have been in progress the whole year, except the winter months, under a waiver of the time limit for completion, and that under the Morris & Cumings Dredging Company was completed September 27, 1902.

The construction and repair of dikes under the United States Fidelity and Guaranty Company's contract has been continued the whole year, and as much progress made as the stages of the water in the river, which were persistently high, would permit, and under the Kirk, Driscoll & Co. contract pile driving was begun in April, 1903.

Dredging, in continuation of the project and for the relief of navigation, was carried on at and near Troy, N. Y., and at Bath and Cox-sackie shoals. The following quantities have been removed from the localities named below and the spoil disposed of according to law, viz:

	Cubic yards.
Coxsackie shoal.....	74,693
In front of Albany.....	126
Bath shoal.....	8,750
Round shoal.....	87
Covills Folly.....	66
In front of arsenal.....	30,537
Arsenal to Congress street.....	8,789
Congress street to Broadway.....	6,282
Broadway to Delaware and Hudson bridge.....	236
Delaware and Hudson bridge to High dock.....	6,760
High dock to State dam.....	13,926
Total.....	150,252

The removal of rock from the channel was continued and the following quantities have been broken up and removed:

Name of reef.	Total area.	Prism removed.	Cost.
	Sq. feet.	Cu. yards.	
Matthews Point.....	2,700	85	\$166.25
Putnam.....	12,000	453	2,151.75
Island Park.....	17,000	2,346	11,143.50
Arsenal.....	160,000	87	413.25
Madison street.....	22,000	90	427.50
Jefferson street.....	105,000	167	793.25
Adams street.....	130,000	447	2,123.25
Washington street.....	30,000	129	612.75
Congress street.....	.....	752	3,572.00
Broadway.....	.....	221	1,049.75
Gravel Island.....	2,500	174	826.50
Hoodack street.....	.....	915	4,346.25
Jay street.....	36,000	5,592	26,562.00
Rensselaer street.....	35,650	5,625	26,718.75
Total.....	.....	17,083	80,906.75

The progress in the construction and repair of dikes was very much delayed during the whole season of 1902 by continuous freshets, there being very few tides as low as the plane of mean low water during the whole season. Since the opening of navigation this spring progress had been very good until about the middle of June, when heavy and continuous rains caused freshets, which have prevented all work on dikes except pile driving.

The following table shows the total quantities of material put in place and secured during the fiscal year:

Pine piling.....	linear feet..	116,568
Sheet piling.....	feet B. M.	340,861
Round timber.....	linear feet..	14,159
Square timber.....	feet B. M.	171,355
Tie-rods and screw bolts.....	pounds..	85,802
Driftbolts and washers.....	do.	28,384
Rubblestone.....	cubic yards..	5,381
Quarry spalls.....	do.	206
Paving stone.....	do.	553
Dredged material.....	do.	1,664

Only one new dike has been under construction, extending along a portion of the west shore of Mulls Plaats for a distance of 2,542 linear feet. On this dike, which is nearly completed, the expenditure during the fiscal year has been \$7,473.88.

Repairs to existing dikes are still in progress, and the following table shows the character of repairs, total length completed or in progress, and cost of each dike:

Name of dike.	Character of work.	Present condition.	Length of dike.	Cost during fiscal year.
			<i>Feet.</i>	
Light-house Island.....	Rebuilt.....	Completed ..	200	\$652.00
Mulls Island.....	New front and filling.	do.	2,200	3,504.91
Middle dike, Coeymans.....	New piling and walling.	do.	280	800.90
Schodack half.....	New front and filling.	do.	703	1,806.31
Schodack (N. Y. S.).....	do.	do.	605.6	1,088.66
Upper Schodack half.....	do.	do.	666	1,471.17
Nine-mile tree.....	do.	do.	647	1,172.26
Castleton (N. Y. S.).....	do.	do.	990.4	2,113.04
Castleton (U. S.):				
Section I.....	Piling and filling.....	do.	520	597.50
Section II.....	New front and filling.	do.	758	1,597.74
Cedar Hill (Poplar Island).....	do.	do.	1,396	2,506.11
Cow Island (old dock).....	do.	do.	194	346.76
Cow Island.....	do.	In progress	1,612	2,153.89
Campbell Island half.....	do.	Completed ..	1,355.4	2,100.36
Campbell Island, single pile.....	do.	In progress	1,370	2,685.12
Winnies.....	do.	Completed ..	983	1,636.61
Papecanes, Section III.....	do.	In progress	1,000	339.64
Overslaugh No. 2.....	Rubble and paving stone.	do.	2,000	473.10
Abbey Cut.....	New front and filling.	Completed ..	404	1,487.29
Beacon Island, paved.....	Rubblestone ..	In progress	100	46.40
Bogart Island.....	New front and filling.	do.	1,300	
Small Island, sheet pile.....	do.	do.	4,370	3,990.34
Douws Point extension.....	do.	do.	1,000	97.50
Douws Point.....	Piling and filling.	do.	1,600	203.16
Bath, sheet pile.....	New front and filling.	do.	3,300	3,223.65
Patroons Lower Island, paved.....	Rubble and paving stone.	do.	300	124.00
Patroons Island revetment.....	do.	do.	40	71.90
Base Island.....	do.	do.	500	362.70
High dike.....	do.	do.	20	16.00
Breaker Island revetment.....	do.	do.	4	6.50

The tide records for the season at Albany and Troy were records of the height of the water more than of tides, the continuous rainfall

keeping the water at freshet height most of the season. The records of one month, August 15 to September 14, 1902, reduced, give about normal range of tides, but the elevation of the low water was above the mean low water plane, 0.4 and 0.8, respectively. For results of tidal records of previous years reference is made to Report of the Chief of Engineers for 1897, page 998, and 1900, page 1490.

Navigation for the season of 1902 closed very suddenly about December 5, when ice formed heavily after a severe snow and wind storm. The ice broke up December 22 and formed a gorge in front of Bath, which remained until early in January, 1903, when it moved downstream to Mulls and remained until March 8, when it broke up and disappeared. Several other ice gorges which formed above Albany in February, and remained until early in March, did much damage to the channel on Round and Kellogg shoals, and also to the paving of the Base and Patroons Lower Island dikes.

Soundings taken since the opening of navigation show a general deterioration of the channel in depth and width, and especially opposite Bath and below North Coeymans ice houses, where the ice gorges were. It is probable that with another thorough dredging many of the bars and shoals will retain the depth of 12 feet required by the project. Others will require additional or higher dikes, but how to prevent bars being formed by ice gorges is a problem yet to be solved, as there are no data from which to base an opinion as to why they form or where to expect them.

The following table shows the widths and depths of deepest navigable channel through the bars and shoals as compared with those of 1902, so far as determined by soundings in 1903:

Locality.	1902.		1903.	
	Width.	Depth.	Width.	Depth.
	Feet.	Feet.	Feet.	Feet.
Coxsackie shoal	50	10.4	150	11
Stonehouse bar	100	11	100	11
Willow Island shoal	300	12	400	12.6
Coeyman Cross-over	350	12	.....	.....
Roach Hook to North Coeymans	200	11	100	9.5
Mulls Cross-over	400	12	200	11
Nine-mile Tree Cross-over	250	11.5	100	11
Castleton bar	150	11	.....	.....
Cedar Hill bar	200	11.5	.....	.....
Winnies bar	200	11.5	240	11.5
Stone Light shoal	300	11.5	.....	.....
Beacon Island shoal	400	12	.....	.....
Bogart Light shoal	60	12	150	11.5
Douws Point Cross-over	200	12	50	12
Cuyler bar	150	11.5	80	11.5
Through draws of bridge at Albany	110	12	100	12
Bath Cross-over	150	11	40	11
Bath shoal	200	12	100	12
Kellogg shoal	100	12	100	11
Fishhouse shoal	200	12	160	12
Round shoal	200	11	150	11
Covills Folly	150	12	.....	.....
Opposite Breaker Island	250	12	.....	.....
Van Buren bar	180	12	.....	.....
Washington bar	200	12	.....	.....
Front of Watervliet Arsenal	100	12	.....	.....
Arsenal to Congress street	300	12	.....	.....
Congress Street Bridge (draw)	100	11.5	.....	.....
Congress street to Broadway, Troy	400	11	300	11.5
Broadway to Delaware and Hudson Company's bridge	200	10.5	200	12
Delaware and Hudson Company's bridge (draw)	50	4.5	50	4.5
Delaware and Hudson Company's bridge (fixed span) to Hoosick street, Troy	100	10	100	10.5
Hoosick street to Rensselaer street	50	5.5	60	10
Rensselaer street to State dam	50	5.5	50	5.5

The above depths refer to the plane of mean low water established in 1876, except between the Delaware and Hudson Company's bridge and State dam, where the plane established by records of 1899 is the reference.

The benefits from the removal of reefs of rock in front of Troy, N. Y., are not yet fully realized, as the final dredging is not completed, and there are still high points of gravel to be removed, but from the south end of the Watervliet Arsenal wharf to the Delaware and Hudson Company's bridge at Troy there is only a small rock area over which there is not 12 feet of water. A channel 60 feet wide has been completed through the large reef above Hoosick street to Rensselaer street, Troy, but the dredging above the reef is still incomplete. There is a reef of rock directly in front of the "Sloop Lock" at the State dam, with only about 4½ feet depth below the plane of mean low water, and the miter sill of the lock is only 5 feet below the same plane. Under present contracts it is expected that a channel 130 feet wide and 12 feet deep will be completed through the large reef between Hoosick and Rensselaer streets, and a channel dredged to the "Sloop Lock" not less than 9 feet deep, unless undeveloped reefs are encountered above that depth.

The dikes passed through the winter and spring with little damage except ordinary wear and tear, but some, on which repairs should have been completed under contracts in force, suffered a loss of piling and stone filling. When the present contracts for dike construction and repairs are completed there will be few timber dikes which will not have been put in good order, but the paved dikes on the Over-slaugh, aggregating a length of 7,236 linear feet, are much in need of a thorough repairing, for in their present condition, unless patched up every season, the paving is liable to be broken by the ice moving out in the spring, and one small break, unrepaired, will be a large one after the next spring's freshet. The necessity for additional dikes, and increasing the height of some of those already built from high water level to 2 feet or more above that plane, the exact amount to be determined in each case experimentally, is more apparent every year. The dikes which should be raised are the upper portion of Small Island dike, about 2,000 feet long, the Cedar Hill dike, except section at Poplar Island, and the Castleton and Schodack dikes built by the State of New York. Dikes will also be required to regulate the channel at Bath shoal, but until the dredging between Albany and Troy is completed it is probably best to leave this section to act as a basin for catching the scoured material from the upper river and to continue to dredge a channel through the shoal every year or two, for this material can be more easily found and removed under present conditions than if it was carried farther down by the currents and distributed over a large area.

This improvement has been under the supervision of Mr. R. H. Talcott, assistant engineer, stationed at Albany.

The available balance and the appropriations recommended for fiscal year ending June 30, 1905, will be applied to continuing the excavation of the proposed channel by means of dredging and rock removal and for maintaining the channel already secured by the removal of any shoals that may be formed by ice gorges or other causes.

To complete this work in a reasonable time and within the original estimate contracts should be authorized for the balance of the work required under the project.

Money statement.

July 1, 1902, balance unexpended	\$491,449.55
June 30, 1903, amount expended during fiscal year	167,541.69
July 1, 1903, balance unexpended	323,907.86
July 1, 1903, outstanding liabilities	62,207.06
July 1, 1903, balance available	261,700.80
July 1, 1903, amount covered by uncompleted contracts	200,402.89
{ Amount (estimated) required for completion of existing project	1,040,356.44
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$400,000.00
For maintenance of improvement	25,000.00
	425,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—

June 30, 1834	\$70,000.00
July 2, 1836	100,000.00
March 3, 1837	100,000.00
July 7, 1838	100,000.00
August 30, 1852	50,000.00
June 26, 1864 (allotment)	33,000.00
June 23, 1866	50,000.00
March 3, 1867	805,188.00
July 25, 1868 (allotment)	85,000.00
April 10, 1869 (allotment)	89,100.00
July 11, 1870	40,000.00
March 3, 1871	40,000.00
June 10, 1872	40,000.00
March 3, 1873	40,000.00
June 23, 1874	40,000.00
March 3, 1875	40,000.00
August 14, 1876	50,000.00
June 18, 1878	70,000.00
March 3, 1879	30,000.00
June 14, 1880	20,000.00
March 3, 1881	15,000.00
August 2, 1882	10,000.00
July 5, 1884	30,000.00
August 5, 1886	26,250.00
August 11, 1888	75,000.00
September 19, 1890	119,400.00
September 19, 1890 (balance)	30,600.00
July 13, 1892	187,500.00
March 3, 1893	500,000.00
August 18, 1894	145,000.00
March 3, 1895	500,000.00
June 11, 1896	480,000.00
June 4, 1897	475,000.00
July 1, 1898	160,408.56
March 3, 1899	100,000.00
June 6, 1900	400,000.00
March 3, 1901	100,000.00
June 13, 1902	225,000.00
	3,303,506.56
Total	4,971,444.56

CONTRACTS IN FORCE.

Name of contractor: Kirk, Driscoll & Co.
 Date of contract: June 28, 1899.
 Date of approval: July 12, 1899.
 Date of commencement: On or before July 27, 1899.
 Date of completion: June 30, 1902. Time limit waived.
 For dredging, at rates of 19 cents and 24½ cents per cubic yard, and for rock removal at \$4.75 per cubic yard.

Name of contractor: The United States Fidelity and Guaranty Company.
 Date of contract: October 11, 1901.
 Date of approval: November 9, 1901.
 Date of commencement: On or before November 10, 1901.
 Date of completion: October 31, 1902.
 For construction and repair of dikes, material to be paid for at following rates: Piles, 9½ cents per linear foot; sheet piling and square timber, \$32 per 1,000 feet B. M.; round timber, 8½ cents per linear foot; iron, 3½ cents per pound; rubblestone and spalls, 80 cents per cubic yard; paving stone, \$1.30 per cubic yard; and hire of dredging plant, \$9 per hour.

Name of contractor: Kirk, Driscoll & Co.
 Date of contract: September 30, 1902.
 Date of approval: October 30, 1902.
 Date of commencement: October 1, 1902.
 Date of completion: November 30, 1903.
 For constructing and repairing dikes, at rates of 12 cents per linear foot for round piling, 10 cents per linear foot for round timber, \$50 per 1,000 feet B. M. for sheet piling and square timber, \$1.50 per cubic yard for large rubblestone, and \$1 per cubic yard for ordinary rubblestone.

Name of contractor: Dunbar & Sullivan.
 Date of contract: September 30, 1902.
 Date of approval: October 21, 1902.
 Date of commencement: October 15, 1902.
 Date of completion: November 30, 1903.
 For rock removal near Troy, N. Y., at rate of \$3.35 per cubic yard.

COMMERCIAL STATISTICS.

The importance of the Hudson as a great waterway of commerce is apparent from the fact that, aside from its own local traffic, which in itself is very large, it absorbs all the traffic of the Erie, Champlain, and Delaware and Hudson canals, besides the great coal trade of the Pennsylvania Coal Company at Newburg and the Erie coal trade at Piermont.

The two principal industries on the river are ice and building material. Eighty-seven ice houses are said to be between Albany and Hudson.

Amount of local commerce, north and south, within limits of improvement.

	Tons.
Brick.....	4, 928
Lumber and timber	614, 112
Vegetable food	446, 648
Hay.....	65, 128
General merchandise	297, 323
Manufactures	144, 640
Ice	1, 114, 716
Stone, cement, etc.....	395, 154
Fuel.....	269, 501
Iron ore	135, 360
Sundries.....	185, 587

Total..... 3, 673, 097

Number of passengers carried in 1902, 1,078,648.

F 13.

IMPROVEMENT OF HARBOR AT SAUGERTIES, NEW YORK.

Operations for the year consisted in repairing the north dike, under contract with Richard Parrott, of Newburg, N. Y., which is still in progress, and in dredging for the relief of navigation under a contract with Edward A. Berry, of Rensselaer, N. Y.

Under the contract with Edward A. Berry 12,000 cubic yards of material were removed from the channel, at a cost of \$3,000.

The dikes are of piling, cut off at an elevation of 2 feet above mean high water, and are now very much decayed on top. An additional waling was put on the south dike during the season of 1901, and the north dike was under repair during the season of 1902, but is not yet completed, owing to damages occasioned by the breaking of the dam, which is located a short distance above the present head of navigation, and the undermining of the piling for a distance of about 125 feet from the east end of the north dike.

The giving way of the dam also caused very heavy shoaling in the channel, and, in fact, filled it up so that navigation for any but small, light-draft boats was impracticable. The dam has been partially repaired, but is still considered unsafe, and will receive further repairs when the water in the creek, which is now high, recedes with drier weather.

The available balance will be expended in completing the repairs of the north dike, dredging a wider channel, and in removing a portion of the reef at Barclays Point, under contracts now in force.

Money statement.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	4,080.72
July 1, 1903, balance unexpended	15,919.28
July 1, 1903, amount covered by uncompleted contracts.....	8,000.00
{ Amount (estimated) required for completion of existing project	24,685.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$24,685.00
For maintenance of improvement	2,500.00
	27,185.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For first project.

By act of—	
July 5, 1884.....	\$5,000
August 5, 1886	15,000
August 11, 1888	12,000
September 19, 1890.....	10,000
July 13, 1892.....	5,000
August 18, 1894	5,000
June 3, 1896	2,500
March 3, 1899.....	2,500
Total	57,000

For present project.

By act of—
 June 13, 1902 \$20,000
 Total for both projects..... 77,000

CONTRACTS IN FORCE.

Name of contractor: Richard Parrott.
 Date of contract: September 10, 1902.
 Date of commencement: September 30, 1902.
 Date of completion: November 30, 1902. Time limit waived December 1, 1902.
 Emergency contract, for repairing dikes, at a cost of \$2,700.

Name of contractor: R. G. Packard Company.
 Date of contract: December 22, 1902.
 Date of approval: January 9, 1903.
 Date of commencement: April 15, 1903.
 Date of completion: November 30, 1903.
 For rock removal, at a cost of \$5,300.

COMMERCIAL STATISTICS FOR 1902.

Articles.	Tonnage.				Total tonnage.
	Receipts.		Shipments.		
	North.	South.	North.	South.	
Lumber and timber				2,000	2,000
Vegetable food				500	500
Hay				1,000	1,000
Merchandise		7,500	3,500	2,000	13,000
Stone				40,000	40,000
Coal	10,000				10,000
Total	10,000	7,500	3,500	45,500	66,500

This freight was carried in 6 steamboats, 3 sailing vessels, and 7 canal barges, draft 7 to 11 feet, tonnage 1,500 to 1,700 tons.
 Number of passengers carried, 14,000.

F 14.

IMPROVEMENT OF HARBORS AT RONDOUT AND PEEKSKILL, NEW YORK.

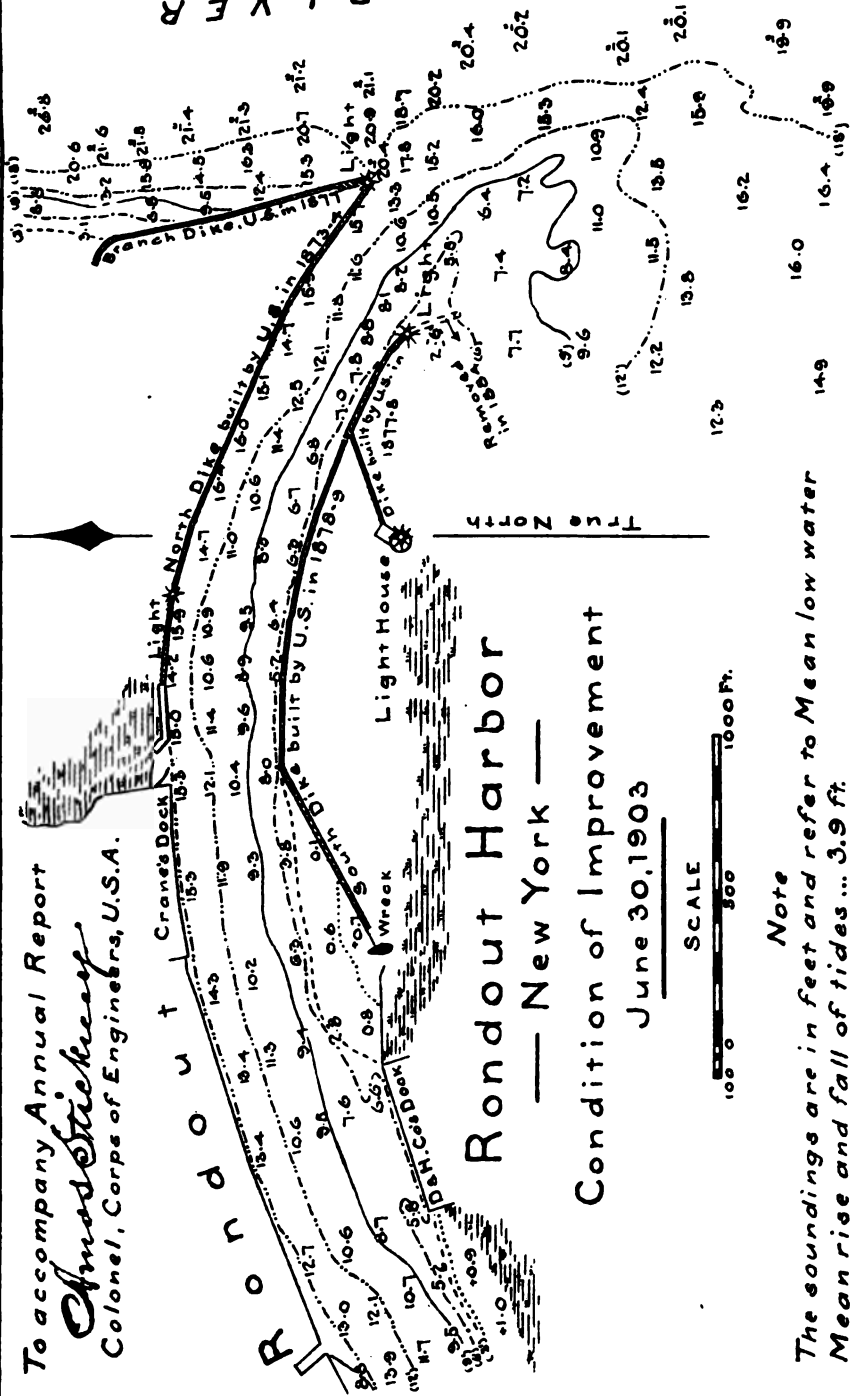
(A) RONDOUT HARBOR.

* * * * *
 The amount expended during the fiscal year was \$525.62, and was applied to repairs of spring and fender piles and to making a survey of the channel.

The channel, 14 feet deep, is nowhere less than 30 feet wide from deep water in the Hudson River, and the least distance between 12-foot contours is 90 feet, but the shoal extending from the outer end of the south dike has continued to work eastward, so that the 9-foot contour is, on an average, about 200 feet farther east than in 1899. This shoal is an obstruction, and boats with tows find it difficult to make the turn

Chond Stickney

HUDSON RIVER



Note

The soundings are in feet and refer to Mean low water
Mean rise and fall of tides ... 3.9 ft.



into the creek, when the tide is running strong flood, without coming in collision with the outer end of the north dike.

The available balance will be expended in dredging off the outer end of the shoal to the depth of 14 feet as far westward as the funds will admit.

Money statement.

July 1, 1902, balance unexpended	\$2,500.00
June 30, 1903, amount expended during fiscal year	525.62
July 1, 1903, balance unexpended	1,974.38
July 1, 1903, outstanding liabilities	74.76
July 1, 1903, balance available	1,899.62
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
June 12, 1872.....	\$10,000	August 11, 1888.....	\$5,000
March 3, 1873.....	20,000	September 19, 1890.....	5,000
June 8, 1875 (allotment) ...	1,000	July 13, 1892.....	5,000
August 14, 1876.....	30,000	August 18, 1894.....	5,000
June 15, 1878.....	30,000	June 3, 1896.....	2,500
August 2, 1882.....	2,000	June 13, 1902 (allotment) ..	2,500
July 5, 1884.....	1,000		
August 5, 1886.....	2,500	Total	121,500

COMMERCIAL STATISTICS FOR 1902.

Articles.	Tons.
General merchandise, lumber, etc	200,000
Coal and other fuel	100,000
Brick and building material	525,000
Cement, lime, and sand	400,000
Ice	60,000
Total	1,285,000

(B) HARBOR AT PEEKSKILL.

* * * * *

No work was done during the fiscal year.

The channel, which was completed in 1899, has shoaled considerably in front of the docks and contracted at other points, so that between the lower and center dock the depth is 9.5 feet for a width of 50 feet, from the center dock to deep water by the north channel the depth is 10 feet for a width of 50 feet, and by the south channel the depth is 10 feet for a width of 100 feet.

The available balance will be expended for maintenance after restoring the dredged channel from lower dock both ways to as great an extent as funds will permit. A survey is about to be made from which to determine the most necessary work.

Money statement.

July 1, 1902, balance unexpended	\$3,600.00
July 1, 1903, balance unexpended	3,600.00

{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—	
June 3, 1896	\$10,000
March 3, 1899	10,000
June 13, 1902 (allotment)	3,000
Total	23,000

COMMERCIAL STATISTICS FOR 1902.

Articles.	Tonnage.				Total tonnage.
	Receipts.		Shipments.		
	North.	South.	North.	South.	
Brick	1,000				1,000
Molding sand	3,000	500			3,500
Clay	1,500				1,500
Manufactures (water pipe)	500				500
Pig iron	4,000	1,000			5,000
Stone, cement, etc		715		2,000	2,715
Coal	3,500	4,000		100	7,600
Emery				1,000	1,000
Total	13,500	6,215		3,100	22,815

F 15.

IMPROVEMENT OF WAPPINGER CREEK, NEW YORK.

* * * * *

No work was done during the fiscal year.

The available funds will be applied to restoring the channel, as far as possible, to its former dimensions.

Money statement.

July 1, 1902, balance unexpended	\$1,500.00
June 30, 1903, amount expended during fiscal year	12.00
July 1, 1903, balance unexpended	1,488.00

APPROPRIATIONS.

By act of—	
September 19, 1890	\$13,000
June 13, 1902	1,500
Total	14,500

COMMERCIAL STATISTICS.

No statistics have been compiled since 1888, during which year the tonnage amounted to 70,000 tons.

F 16.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of coal barge B. L. Collar in Bronx River, New York.—Under date of June 12, 1902, this wreck was reported by letter from the Bronx Company, and an examination showed that the barge was sunk at the sharp bend opposite the wharves of the Bronx Company. * * * Its removal was authorized by Department indorsement of June 25, 1902, and was completed August 2, 1902, the total cost for the removal being \$175, the balance of the allotment, \$325, not being required. Final report on this removal was submitted August 4, 1902.

Wreck of canal boat Alert in Hudson River near Hoboken, N. J.—This was a derelict canal boat found floating in the channel of the Hudson River and temporarily secured and tied to Pier 11, Hoboken. Being a menace to navigation, an order was given the Baxter Wrecking Company to remove it, at an agreed price of \$175, and reported to the Department July 23, 1902. This action was approved July 28, 1902, and an allotment made of the amount. The removal was completed, at a cost of \$175, August 1, and final report submitted August 4, 1902.

Wreck of the sloop Pell in the East River, New York.—On December 10, 1902, information was received that the oyster sloop *Pell* had sunk in the East River off Pier 7, Brooklyn, and was a dangerous obstruction to navigation, its mast appearing above water at low tide. It was ascertained the owner, Mattavis J. Decker, had abandoned it, and as it was a menace to navigation immediate bids were asked by telephone for its removal. The lowest bid received was from the Baxter Wrecking Company, who agreed to take out the spars, which constituted the principal obstruction, at a cost of \$100. This was ordered and received the sanction of the Department December 20, 1902, an allotment of \$100 being made. The spars were removed January 24, 1903, the hull remaining at the bottom of the river in from 42 to 48 feet of water. Final report was submitted January 26, 1903.

Wreck of the barge Bertha Miner in the Bronx River, New York.—This barge, loaded with coal, was sunk in the Bronx River near the foot of One hundred and seventy-seventh street, New York City, on February 27, 1903, and became an obstruction to navigation, completely blocking the channel at that point. The owner, Daniel Cavanaugh, after removing most of the coal, abandoned the boat March 31, and public notices were issued April 1, 1903, inviting bids for its removal. Five bids were received, and an order given to John F. Ghee, of Westchester, N. Y., the lowest bidder, for its removal, at a cost of \$248, the wreck and remaining cargo to become the property of the contractor. The boat and cargo were completely removed and the channel cleared May 9, 1903, at a total cost of \$248, and final report submitted May 12, 1903.

Removal of an unknown wreck in Hudson River near North Coeymans, N. Y.—This wreck was reported March 13, 1903, as a menace to navigation, and, as the owner could not be found, public notices were issued March 17, 1903, inviting bids for its removal. All bids received under this notice were considered too high and new bids were invited April 3, 1903. The lowest bid received was from William Parrott, of Newburgh, N. Y., \$170, which was accepted and the removal completed May 27, 1903. Final report was submitted May 29, 1903.

Wreck of barge Jas. Cogswell in Hudson River at Albany, N. Y.—This barge, loaded with coal, sunk at the foot of Madison street, Albany, N. Y., on November 11, 1902. It was supposed to be the property of F. S. Hathaway, of Coeymans, N. Y., but he disclaimed ownership. Public notices were issued December 17, 1902, inviting bids for its removal. The lowest received was from John Dunfee & Co., of Albany, N. Y., who proposed to remove it for \$500, the wreck and cargo to become the property of the contractors. By authority of the Department this bid was accepted and an allotment made December 31, 1902. Order for removal was given Dunfee & Co. January 26, 1903, but owing to continued high water in the Hudson River the wreck was not completely removed until May 28, 1903. Payment of \$500 was made the contractors June 10 and final report submitted to the Department June 11, 1903.

F 17.

MODIFICATION OF HARBOR LINES IN EAST RIVER, NEW YORK, AT NORTH BROTHER ISLAND.

DEPARTMENT OF DOCKS AND FERRIES

OF THE CITY OF NEW YORK,

New York, May 16, 1902.

SIR: I transmit herewith a map^a in duplicate, together with a technical description showing the proposed modification of the bulkhead and pierhead line on North Brother Island, and respectfully request your approval thereof.

This modification is requested on behalf of the department of health of this city, the commissioner of that department having reported that the present pier at North Brother Island does not provide sufficient docking facilities. The northerly side of the pier can not be used for docking steamboats, owing to the proximity of the water-supply pipes and electric cables. When coal, building materials, etc., have to be unloaded for the use of the hospital, the barge must lay in the berth at the southerly side of the pier, which is the ordinary berth for the steamboat. As the steamboat is obliged to land at the end of the dock, the large boats passing in the shallow water of the river adjacent at the end of the line render it liable to injury in this position.

The health commissioner therefore requests that a new pier be constructed at North Brother Island, about 130 feet southerly from the present pier.

^aNot printed.

The pier which is requested by the health department would project outside the United States Government pierhead line established around North Brother Island about 50 feet, and this application for the modification of the pierhead line is therefore transmitted to you.

Yours, respectfully,

RUSSELL BLEECKER,
Secretary.

Hon. ELIHU ROOT,
Secretary of War, Washington, D. C.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 21, 1902.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.
To be returned.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, June 26, 1902.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the board of this date.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 8, 1902.

Respectfully returned to the Secretary of War.

The department of docks and ferries of the city of New York, on behalf of the department of health, requests a modification of the established harbor lines on the western side of North Brother Island, East River, New York, for the reason that the existing line does not provide sufficient docking facilities.

The papers have been referred to the New York Harbor Line Board, which has carefully considered the question, conferring on the subject with the local authorities.

In its report of June 26, 1902, herewith, the Board recommends new lines for the point in question, which, while not agreeing with the modified line originally proposed, are acceptable to the applicants; the Board further recommends a new line for the remaining sides of the island.

I recommend that the lines selected by the Board be approved and that the Secretary place his approval upon the accompanying report and tracing,^a both of which have been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

^a Map not printed.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, June 26, 1902.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on the application of the department of docks and ferries of New York City for modification of the bulkhead lines at North Brother Island, New York, referred for consideration and report by your indorsement of May 21, 1902.

The Board has carefully considered this matter and a conference was had with the engineer in chief of the dock department, to whom it was explained that the navigation interests of the harbor made it undesirable to modify the bulkhead line to the extent applied for. The dock department has accordingly modified its original application, as will be seen by its inclosed letter dated June 12, 1902.

The Board now recommends a new pierhead line nearly the same as the bulkhead line requested by the dock department in its original application; also a bulkhead line on the westerly side of North Brother Island within the limits of the recommended pierhead line and nearly coinciding with the harbor lines approved by the Secretary of War June 9, 1891.

The Board also recommends a new pierhead and bulkhead line on the northerly side of the island, the continuation of which on the easterly and southerly side practically coincides with the existing harbor lines for the locality.

The modified lines herein recommended are shown in red on the accompanying tracing,^a and are described as follows:

PIERHEAD LINE.

Beginning at a point in the easterly side of the main hospital building, prolonged northerly, 146 feet from the northeast corner of said hospital building; thence westerly in a straight line, perpendicular to the northerly prolongation of the easterly side of the hospital building, a distance of 370 feet; thence southerly in a straight line to a point in the northerly boundary line of the United States Government land, prolonged westerly 210 feet from the southwest corner of the sea wall; thence southeasterly in a straight line to a point in the pierhead and bulkhead line approved by the Secretary of War January 9, 1891, in a line 50 feet southeasterly of the southwest corner of the sea wall and 368 feet southerly of (perpendicular distance) the northerly boundary line of the United States Government land; the southerly end of this last described line is coincident with the bulkhead line for a distance of 115 feet; thence southerly and easterly and northerly coincident with the bulkhead line, and nearly coincident with the pierhead and bulkhead line approved by the Secretary of War January 9, 1891, on the arc of a circle with a radius of 107 feet for a distance of 179.2 feet; thence on the arc of a circle with a radius of 1,493 feet for a distance of 430.4 feet; thence in a straight line tangent to the aforesaid arc for a distance of 280 feet; thence on the arc of a circle with a radius of 947 feet for a distance of 403.3 feet; thence on the arc of a circle with a radius of 510 feet for a distance of 366.6 feet; thence northerly and westerly on the arc of a circle with a radius of 300 feet for a distance of 272.6 feet; thence in a straight line tangent to the aforesaid arc for a distance of 146 feet; thence on the arc of a circle with a radius of about 490 feet for a distance of about 323.1 feet to the point of beginning of the pierhead line in the northerly prolongation of the easterly side of the main hospital building 146 feet from the northeast corner of the hospital building.

BULKHEAD LINE.

Beginning at the point where the bulkhead line departs from the pierhead line at the southwest side of the island, in a line 16.35 feet northwesterly from the south-

^a Maps not printed.

west corner of the sea wall and 274.08 feet southerly of (perpendicular distance) the northerly boundary line of the United States Government land prolonged westerly; thence northerly in a straight line for a distance of 289 feet to a point in the northerly boundary line of the United States Government land prolonged westerly 108 feet from the southwest corner of the sea wall; thence on the arc of a circle with a radius of 930 feet for a distance of 314.1 feet; thence northerly in a straight line tangent to the aforesaid arc for a distance of 270 feet; thence northerly and easterly on the arc of a circle with a radius of 685 feet for a distance of 300.9 feet; thence northeasterly in a straight line tangent to the aforesaid arc for a distance of about 57 feet to the point of intersection with the pierhead line; thence the bulkhead line is coincident with the pierhead line, as described before.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
S. M. MANSFIELD,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

WAR DEPARTMENT, *July 11, 1902.*

Approved.

E. ROOT,
Secretary of War.

F 18.

MODIFICATION OF HARBOR LINES IN EAST RIVER AT LAWRENCE POINT AND BERRIAN ISLAND, NEW YORK.

NEW YORK, *April 11, 1902.*

SIR: We beg to submit herewith a petition^a on behalf of the Astoria Light, Heat and Power Company, of this State, for a modification of the pier and bulkhead line at Berrian Island and Lawrence Point upon the East River at Hell Gate in New York Harbor. The petition, we think, fully sets forth the nature of the application and the facts upon which it is based. If desired, we are ready to appear before the appropriate board having jurisdiction over the matter and make proof on behalf of the company of such facts.

Very respectfully, yours,

WINTHROP & STIMSON.

The honorable the SECRETARY OF WAR.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 15, 1902.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for report by the New York Harbor Line Board, after due advertisement and public hearing.

To be returned.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

^a Not printed.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, June 17, 1902.

Respectfully returned to the Chief of Engineers, inviting attention to report of the Board of this date.

CHAS. R. SUTER,
*Colonel, Corps of Engineers,
 President of the Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
 U. S. ARMY,
June 30, 1902.

Respectfully returned to Colonel Suter.

The waterway of the petition, called Berrian Creek and lying immediately south of Berrian Island, is not the Berrian Creek mentioned in Colonel Houston's report, November 1, 1892, but only the northwest entrance of that creek.

The set of the currents is chiefly to the westward through the northwest entrance, and the tendency is to keep that entrance open. This makes the northwest entrance the principal entrance to the creek and the natural outlet.

The closing of the northwest entrance will probably increase the shoaling on the east of the creek entrance, and unless constant dredging is done the eventual result will be the absolute closing of the creek by an enlargement of the already large flats in Bowery Bay.

The rights of the Astoria Light, Heat and Power Company in the vicinity were acquired subsequent to 1891, after the harbor lines of that year had been established in that locality, and must now be considered in relation to all other riparian rights attaching to this waterway.

Since the northwest entrance is a natural way which has been habitually used from time immemorial by commerce, the Board is requested to reconsider the subject and report whether, all things considered, the Secretary of War, vested by law with the "protection and preservation" of navigable waters, has the right to authorize the closing of the northwest entrance, even if the Astoria Light, Heat and Power Company agrees to dredge the eastern entrance to the depth proposed by it.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,
 U. S. Army.*

[Fifth indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, July 2, 1902.

Respectfully returned to the Chief of Engineers.

The shallow channel between Berrian Island and Long Island, called "Berrians Creek" on the accompanying tracing,^a is not navigated and is not navigable in any ordinary sense.

The Astoria Light, Heat and Power Company constitutes the only riparian owner along this so-called creek; but the channel can not be

^a Not printed.

closed without State action, the bottom of the creek being State property. Should any individuals be injured by the filling in of this channel, they have recourse in the State courts.

The creek named "Steinway Creek" on the tracing and "Luyster Creek" in the application is not a flowing stream, but a short cul-de-sac or estuary maintained in navigable condition by dredging. It is practically a slip controlled by private parties for their own benefit.

The Board believes that the general public has no interest in the navigation of these small channels, and that their improvement and uses may well be relegated to State authorities by the establishment of the harbor line proposed.

The filling due to the closing of the channel southwest of Berrian Island will evidently be the same as the general fill along the shores of Bowery Bay, extremely slow, inasmuch as the sea water carries little sediment and the currents carrying sand will be cut off.

For the Board:

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 28, 1902.

Respectfully returned to the Secretary of War.

The Astoria Light, Heat and Power Company, through its representatives, makes application for a modification of the established pierhead and bulkhead line at Lawrence Point and Berrian Island, East River, New York.

The matter was referred to the New York Harbor Line Board, which has given the subject careful consideration after a public hearing, of which due notice was given to interested parties.

Inviting attention to its report of the 17th ultimo (herewith), it will be seen that the Board recommends for the locality in question a new pierhead and bulkhead line, which is accurately described in the report and delineated on the accompanying chart.^a I recommend that the modified line selected be approved and that the Secretary place his approval upon the report and tracing, both of which have been prepared for his signature.

A. MACKENZIE,
Acting Chief of Engineers.

[Seventh indorsement.]

WAR DEPARTMENT, *August 1, 1902.*

Respectfully returned to the Chief of Engineers.

The questions presented in the within application have been very carefully considered. The Acting Secretary of War does not, however, feel justified at present in approving the closing of Berrians Creek.

W. SANGER,
Acting Secretary of War.

^a Not printed.

[Twelfth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 3, 1903.

Respectfully returned to the Secretary of War, with tracing showing modification of the harbor line recommended by the Board in its report of June 17, 1902. A description of the modification is given in the report of the Board. Both the tracing^a and the report have been prepared for the signature of the Secretary of War.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, June 17, 1902.

GENERAL: The New York Harbor Line Board has the honor to submit the following report on the application of the Astoria Light, Heat and Power Company for modification of pier and bulkhead lines at Berrian Island, East River, New York.

In accordance with your indorsement of April 15, 1902, referring this case to the board for report, a public hearing was given to interested parties on May 12, 1902, after due advertisement, and the stenographic report^a of this hearing is forwarded herewith, marked A.

After careful consideration the Board recommends a new pier and bulkhead line covering the locality in question, as shown on the accompanying tracing^a in red.

The new lines, as herein recommended, are described as follows:

Beginning at a point in the pierhead and bulkhead line approved by the Secretary of War March 4, 1890, and February 15, 1902, in the northerly side of Riker avenue, prolonged westerly, 325 feet from the easterly side of the Boulevard; thence northerly in a straight line to a point in the southerly side of Berrian avenue, prolonged westerly, 280 feet from the easterly side of the Boulevard; thence to a point in the northerly prolongation of the line just described for a distance of 385 feet; thence easterly in a straight line to a point in the easterly side of Merchant street, prolonged northerly, 1,625 feet from the northerly side of Berrian avenue; thence in a straight line to a point in the easterly side of Chauncey street, prolonged northerly, 1,690 feet from the northerly side of Berrian avenue; thence in a straight line to a point in the easterly side of De Bevoise avenue, prolonged northerly, 1,665 feet from the northerly side of Berrian avenue; thence in a straight line to a point in a line 1,445 feet northerly of (perpendicular distance) the northerly side of Berrian avenue, prolonged easterly, 770 feet easterly of the easterly side of De Bevoise avenue; thence southerly in a straight line to a point in a line 340 feet northerly of (perpendicular distance) the northerly side of Berrian avenue, prolonged easterly, 780 feet easterly of the easterly side of De Bevoise avenue; thence on the arc of a circle with a radius of 450 feet to a point in a line 22 feet south of (perpendicular distance) the northerly side of Berrian avenue, prolonged easterly, 600 feet easterly of the easterly side of De Bevoise avenue; thence in a straight line to a point in a line 240 feet easterly of (perpendicular distance) the easterly side of De Bevoise avenue 780 feet northerly of the northerly side of Riker avenue; thence along the westerly shore of Steinway Creek on the arc of a circle with a radius of 800 feet to a point in a line 305 feet easterly of (perpendicular distance) the easterly side of De Bevoise avenue 435 feet northerly of the northerly side of Riker avenue; thence on a curve parallel to the pierhead and bulkhead line of the easterly shore of Steinway Creek, approved by

^a Not printed.

the Secretary of War February 8, 1902, and at a distance of 100 feet therefrom to a point in the northerly side of Riker avenue 387.6 feet westerly of the westerly side of Blackwell street.

Respectfully submitted

CHAS. R. SUTER,
Colonel, Corps of Engineers.

S. M. MANSFIELD,
Colonel, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

WAR DEPARTMENT, *January 3, 1903.*

Approved.

WM. CARY SANGER,
Assistant Secretary of War.

F 19.

MODIFICATION OF HARBOR LINES ON THE WESTERLY SHORE OF EAST RIVER, BETWEEN EAST THIRTEENTH AND EAST EIGHTEENTH STREETS, NEW YORK.

DEPARTMENT OF DOCKS AND FERRIES
OF THE CITY OF NEW YORK,
New York, May 12, 1903.

SIR: I transmit herewith, in duplicate, plan^a prepared by this department showing a desired modification of the pierhead and bulkhead lines between Thirteenth and Eighteenth streets, on the East River. This plan, if approved by you, will permit the erection of a permanent concrete wall, or such other permanent structure as might be later determined upon, along the proposed bulkhead lines and outside of the existing lines of solid filling thereat. It will be seen from the plan submitted herewith that the line of the existing solid filling south of Seventeenth street, East River, is close to this proposed bulkhead line.

This department respectfully requests that you approve of this modification of the pierhead and bulkhead lines. Descriptions of the desired modifications are as follows:

The proposed modification of the bulkhead line consists in abandoning that portion of the bulkhead line established by the Secretary of War in 1890 lying between the northerly line of East Seventeenth street and a point 85 feet south of the southerly line of East Fourteenth street, and substituting therefor a line beginning at the intersection of the northerly line of East Seventeenth street with the bulkhead line established by the Secretary of War in 1890 and running thence easterly along the easterly prolongation of the northerly line of East Seventeenth street 535 feet; thence southerly in a straight line to a point in a line drawn parallel with and 85 feet southerly from the southerly side of East Fourteenth street, said point being

^a Not printed.

distant 119 feet easterly from the bulkhead line established by the Secretary of War in 1890, measured on said parallel line; thence westerly 119 feet on a line drawn parallel with and 85 feet southerly from the southerly side of East Fourteenth street to the bulkhead line established by the Secretary of War in 1890.

The proposed modification in the pierhead line consists in abandoning that portion of the pierhead line established by the Secretary of War in 1890 between the southerly side of East Eighteenth street prolonged and the southerly side of East Fourteenth street prolonged, and substituting therefor a line beginning at a point in the pierhead line established by the Secretary of War in 1890 where said pierhead line intersects the easterly prolongation of the southerly line of East Eighteenth street, running thence southerly in a straight line to a point in the easterly prolongation of the northerly line of East Seventeenth street, distant 535 feet easterly from the bulkhead line established by the Secretary of War in 1890; thence still southerly in a straight line to a point in the pierhead line established by the Secretary of War in 1890 where the easterly prolongation of the southerly side of East Fourteenth street intersects the same.

Yours, respectfully,

RUSSELL BLEECKER, *Secretary.*

Hon. ELIHU ROOT,
Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 16, 1903.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for consideration and report by the New York Harbor Line Board.
To be returned.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Third indorsement.]

THE NEW YORK HARBOR LINE BOARD,
ARMY BUILDING,
New York City, June 2, 1903.

Respectfully returned to the Chief of Engineers, inviting attention to the report of the Board of this date.

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 5, 1903.

Respectfully returned to the Secretary of War.

The department of docks and ferries of the city of New York requests a modification of the established harbor lines on the westerly shore of East River, between East Thirteenth and East Eighteenth streets, New York City, in order to permit of certain permanent improvements being made at that point.

The matter has been referred to the New York Harbor Line Board for consideration and attention is respectfully invited to the Board's report of the 2d instant in a separate paper herewith, from which it appears that the contemplated modifications make no serious encroachments upon the navigable waterway of East River at the point in question.

Concurring in the views of the Board, I recommend that the applicant's request be granted and, should this action meet with the sanction of the Secretary of War, I further recommend that he indicate his approval upon the Board's report and the accompanying tracing," both of which have been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, June 2, 1903.

GENERAL: The New York Harbor Line Board has considered the application of the department of docks and ferries of New York City for a modification of the pierhead and bulkhead lines between Thirteenth and Eighteenth streets, East River, New York, referred to it for consideration and report by your indorsement of May 16, 1903, and has the honor to submit the following report thereon:

From the inclosed memorandum ^a it appears that the bulkhead which the dock department seeks to have included within the established lines by the War Department is that which has existed through the action of the State and local authorities for nearly half a century, and the present application seeks to have the same legalized by the United States. Inasmuch as the contemplated modifications make no serious encroachments upon the navigable waterway of the East River in the described locality, the application is recommended for approval.

A tracing is forwarded this date, in a separate roll, showing the desired modifications, which are described as follows:

BULKHEAD LINE.

Beginning at a point in the bulkhead line approved by the Secretary of War April 25, 1890, 85 feet southerly of (perpendicular distance) the southerly side of East Fourteenth street; thence easterly in a straight line for a distance of 119 feet parallel to the southerly side of East Fourteenth street; thence northerly in a straight line to a point in the easterly prolongation of the northerly side of East Seventeenth street 535 feet from the bulkhead line approved by the Secretary of War April 25, 1890; thence westerly in a straight line along the easterly prolongation of the northerly side of East Seventeenth street 535 feet to the point of intersection with the bulkhead line approved by the Secretary of War April 25, 1890.

PIERHEAD LINE.

Beginning at a point in the easterly prolongation of the southerly side of East Fourteenth street 288 feet from the westerly side of Tompkins street; thence northerly in a straight line to a point in easterly prolongation of the northerly side of East Seventeenth street 535 feet from the bulkhead line approved by the Secretary of War

"Not printed.

April 25, 1890; thence in a straight line to a point in the pierhead line approved by the Secretary of War April 25, 1890, in the easterly prolongation of the southerly side of East Eighteenth street 522 feet from the bulkhead line approved by the Secretary of War April 25, 1890.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.

AMOS STICKNEY,
Colonel, Corps of Engineers.

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First Indorsement.]

WAR DEPARTMENT, June 9, 1903.

Approved.

WM. CARY SANGER,
Assistant Secretary of War.

F 20.

MODIFICATION OF HARBOR LINE ALONG THE EASTERN SHORE OF
THE EAST BRANCH OF NEWTOWN CREEK AT BROOKLYN, NEW
YORK.

192 BROADWAY, NEW YORK CITY,
September 23, 1902. 4

SIR: As the attorney for and on behalf of Dr. Carlos F. Macdonald and John H. Voorhees of the city of New York, executors of the estate of Garrett L. Hardy, deceased, I beg leave to submit the following:

Garrett L. Hardy died September 5, 1901. His estate is now in course of settlement. Among other property of which he died possessed was a certain piece or parcel of land containing about 5 acres, situated on Metropolitan avenue and Newtown Creek in the borough of Brooklyn in the city of New York. The said Hardy owned a one-quarter interest in said piece of land. On this property has been erected an extensive crib dock for a distance of 664 feet on Newtown Creek.

In the course of the settlement of the estate which has been nearly completed it became necessary to dispose of the interest of said Hardy in said land, and as it is found impossible to divide said land it has become necessary to sell the whole parcel. A careful survey of the premises shows that the aforesaid dock encroaches upon the bulkhead and pier lines of the United States Government for a distance of 412 feet, varying in width from 5½ feet to zero.

This encroachment, though innocently made, and said dock having been built before the bulkhead and pier line of the Government were established in 1890, constitutes a serious cloud upon the title of the property and prevents its sale.

A purchaser for said property has been found and the price agreed upon, but, owing to this cloud upon the title, the sale has been indefinitely postponed, thereby preventing the settlement of the estate.

I inclose herewith a printed petition^a for the convenience of the War Department, accompanied by a map^a of the premises, which petition and map show in detail all of the facts in relation to said property.

I would most respectfully urge upon the attention of the War Department, for the foregoing reasons, the necessity for a special consideration of this application.

In addition to the reasons set forth in said petition for speedy action—and your attention is particularly called to paragraphs 7, 22, and 23—one of the surviving partners is a man in advanced years, in the event of whose death serious complications would arise by the reason of heirs and minors.

The petition particularly prays for a change of the bulkhead and pier lines of the Government so that they may coincide with the lines of said dock, to the end that the cloud upon the title upon the afore-said property may be removed.

As shown in said petition, it is practically impossible to remove the encroachment by reason of the nature of the dock. It is 21 feet in width, heavily built of stone and timber work, and to conform with the Government lines would entail its destruction and entire rebuilding. Moreover this work would require a long period of time.

I am, yours, with the highest respect,

GOODWIN BROWN.

The Hon. WILLIAM CARY SANGER,
Assistant Secretary of War, Washington, D. C.

[First indorsement.]

WAR DEPARTMENT, *September 23, 1902.*

Respectfully referred to the Chief of Engineers, inviting attention to the statements contained in the within letter, and with request for such action by him as is proper under the circumstances.

WM. CARY SANGER,
Acting Secretary of War.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 24, 1902.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, for early report by the New York Harbor Line Board.

As the conditions seems to favor compliance with the application, the Secretary of War is desirous that the matter should have immediate attention.

In case the Board recommends that the harbor line be modified the Board is requested to submit a map of the modified line for the signature of the Secretary of War.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

^aNot printed.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, September 27, 1902.

Respectfully returned to the Chief of Engineers with recommendation that the existing pier and bulkhead line at the eastern shore of the east branch of Newtown Creek be modified as shown in red on the accompanying tracing.^a A harbor line lithographic map^a showing the existing pier and bulkhead line, the proposed modified line, and the location of Hardy, Voorhees & Co.'s dock also forwarded herewith.^a

The following is a description of the modified pier and bulkhead line as now recommended:

Beginning at a point in the northerly side of the Metropolitan avenue trestle across the east branch of Newtown Creek where it intersects the pierhead and bulkhead line of the easterly shore, approved by the Secretary of War December 29, 1890, said point being 270 feet east of (perpendicular distance) the westerly side of Scott avenue, prolonged southerly, and 738 feet south of the southerly side of Grand street; thence in a straight line to a point in a line 204 feet east of (perpendicular distance) the easterly side of Scott avenue 298.25 feet south of the southerly side of Grand street; thence in a straight line to a point in a line 210 feet east of (perpendicular distance) the easterly side of Scott avenue 293.75 feet south of the southerly side of Grand street; thence northeasterly along the pierhead and bulkhead line approved by the Secretary of War December 29, 1890.

For the Board.

CHAS. R. SUTER,
*Colonel, Corps of Engineers,
 President of the Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
 U. S. ARMY,
September 30, 1902.

Respectfully returned to the Secretary of War.

Attention is invited to the report of the New York Harbor Line Board, in third indorsement hereon, in which it is recommended that the existing pier and bulkhead line at the eastern shore of the east branch of Newtown Creek be modified as shown in red on the accompanying tracing and described in the said indorsement.

I concur in the recommendation of the Board, and recommend that the Secretary of War place his approval upon this paper and upon the map which has been prepared for his signature.

G. L. GILLESPIE,
*Brig. Gen., Chief of Engineers,
 U. S. Army.*

[Fifth indorsement.]

WAR DEPARTMENT, *October 3, 1902.*

Approved.

E. ROOT,
Secretary of War.

^a Not printed.

F 21.

MODIFICATION OF HARBOR LINES IN HUDSON RIVER AT ALBANY,
NEW YORK.CITY OF ALBANY, MAYOR'S OFFICE,
Albany, January 29, 1903.

SIR: I have the honor to transmit a map^a showing the established bulkhead line and a proposed modification along same between the north and south bounds of the city of Albany. The city of Albany has built a permanent bulkhead between Herkimer and Westerlo streets, and is desirous of constructing more permanent bulkheads along the front of the city, and would respectfully ask that the lines be changed to correspond with the broken line shown on the accompanying blueprint.

Very respectfully, yours,

CHAS. H. GAUS,
*Mayor.*Hon. ELIHU ROOT,
Secretary of War, Washington, D. C.

[First indorsement.]

U. S. ENGINEER OFFICE,
New York, March 25, 1903.

Respectfully submitted to the Chief of Engineers, U. S. Army, with the information that the within letter and accompanying tracing were forwarded to me through my assistant at Albany, to whom they were handed by the mayor of Albany.

It is recommended that the matter be referred to the New York Harbor Line Board.

AMOS STICKNEY,
Colonel, Corps of Engineers.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 28, 1903.

Respectfully referred to Col. Charles R. Suter, Corps of Engineers, president New York Harbor Line Board, for consideration and recommendation by the Board.

A. MACKENZIE,
Acting Chief of Engineers.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, April 3, 1903.

Respectfully returned to the Chief of Engineers, inviting attention to report of this date.

CHAS. R. SUTER,
*Colonel, Corps of Engineers,
President of the Board.*

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 11, 1903.

Respectfully returned to Col. Charles R. Suter, Corps of Engineers, president New York Harbor Line Board.

It is noted that the modification proposed places the harbor line in places inside the former line, cutting off from the dock area now permitted. An opening into the "basin" is also closed.

Information is desired whether the placing of the line nearer shore or closing basin will affect any riparian rights or result in any protests from riparian owners.

The legend on the map states:

The bulkhead line defines the limit of solid filling, the pierhead line the limit to which open-piled structures may be built.

It is understood that no pierhead lines are shown, they being coincident with the bulkhead line, and the attention of the Board is invited to the propriety of omitting references to the pierhead lines.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Fifth indorsement.]

NEW YORK HARBOR LINE BOARD,
New York City, May 4, 1903.

Respectfully returned to the Chief of Engineers.

In examining the maps at the time the modification was agreed upon by the Board, the fact that there were small recessions recommended from established harbor lines was overlooked. The tracing has been corrected to meet this objection, and that part of the legend relative to "pierhead line" eliminated. The Board is of opinion that drawing the line in front of the entrance to the "basin" will not affect any riparian rights, the basin being private or corporate property.

Inclosed herewith is a corrected description of the proposed modified lines, to take the place of that incorporated in the Board's report of April 3, 1903.

The modification as thus corrected substantially covers the application of the mayor of Albany, N. Y., and is recommended for approval.

For the Board:

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 16, 1903.

Respectfully forwarded to the Secretary of War.

The mayor of the city of Albany, N. Y., requests a modification of the established harbor line on Hudson River along the city front in order to permit of certain proposed municipal improvements.

This application has been referred to the New York Harbor Line Board, which recommends for adoption a modified line slightly differ-

ing from the one proposed by Mayor Gaus, but substantially complying with his application.

I recommend that the modified line selected by the Board and shown on the accompanying tracing^a be approved by the Secretary of War, and that the Secretary place his approval upon said tracing and upon the written description of the line herewith, both of which have been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF THE NEW YORK HARBOR LINE BOARD.

NEW YORK HARBOR LINE BOARD,
New York City, April 3, 1903.

GENERAL: The New York Harbor Line Board has considered the application of the mayor of Albany, N. Y., for a modification of existing bulkhead line between the north and south bounds of Albany, N. Y., which was referred to the Board for consideration and recommendation by your indorsement of March 28, 1903, and has the honor to recommend a modification of the existing bulkhead line in the locality in question as shown on a tracing which accompanies this report.

The modified bulkhead line, as now recommended, is described as follows:

Beginning at a point in a line passing through the south gable of the pump house 75.45 feet easterly from (perpendicular distance) the base line passing through the center of the south gable of the pump house of the Albany waterworks at the filter beds, and city monument No. 304; thence in straight lines to points fixed by the following coordinates, referred to aforesaid base line with the point at the center of the south gable as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
2,007.0 feet	50.0 feet
3,347.0 feet	25.0 feet
3,422.0 feet	27.0 feet
3,522.0 feet	32.0 feet

thence in straight lines to points fixed by the following coordinates referred to the base line passing through aforesaid city monument No. 304 and city monument No. 305, with monument No. 304 as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
1,233.0 feet	46.0 feet
1,333.0 feet	41.0 feet
1,433.0 feet	27.0 feet

thence in straight lines to points fixed by the following coordinates referred to the base line passing through city monument No. 305 and a point in a line passing through city monument No. 154, 7 feet north of and parallel to the southerly line of North Ferry street and easterly 178.12 feet therefrom, with monument No. 305 as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
100.0 feet	35.0 feet
1,013.0 feet	63.88 feet

thence in straight lines to points fixed by the following coordinates, referred to the base line joining a point in a line passing through city monument No. 154, 7 feet north of and parallel to the southerly line of North Ferry street and easterly 178.12

^a Not printed.

feet therefrom, and a point 25 feet from the southeasterly corner of the westerly abutment of the New York Central and Hudson River Railroad Company's freight bridge, measured on a line parallel to the center line of said bridge, with the point described by monument No. 154 as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
565.0 feet	11.0 feet
1,191.0 feet	11.0 feet

thence in a straight line to a point fixed by the following coordinates, referred to the base line passing through the point which is 25 feet from the southeasterly corner of the westerly abutment, as described before, and a bolt set in the northeasterly corner of the coping of the masonry wall at the southerly intake of the Albany city waterworks, with the point at the bridge as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
819.0 feet	10.0 feet

thence in straight lines to points fixed by the following coordinates, referred to the base line passing through the bolt, as described before, and city monument No. 303, situate 88.7 feet from the westerly side of Broadway, in the northerly side of Madison avenue prolonged easterly, with the bolt as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
1,196.0 feet	0.0 feet, or 35.26 feet from the southeasterly corner of foundation of building.
1,958.0 feet	0.0 feet, or 30.72 feet from northeasterly corner of foundation of building.
2,456.0 feet	0.0 feet, or 30.70 feet from southeasterly corner of foundation of building.
2,476.0 feet	0.0 feet, the point of intersection of the base line with southerly face of State street pier.

At this point the bulkhead line terminates, and begins again at a point on the westerly side of the basin, and continues thence in straight lines to a point in the northerly side of Madison avenue, said points being fixed by the following coordinates, referred to the base line passing through the bolt, as described before, and city monument No. 303, 88.7 feet from the westerly line of Broadway, with the bolt as the origin:

<i>Abcissæ.</i>	<i>Ordinates.</i>
2,579.0 feet	182.0 feet, or 266 feet from the westerly side of Broadway, measured along the northerly line of Hamilton street prolonged easterly.
3,126.0 feet	150.0 feet

thence in a straight line to a point in the southerly side of Madison avenue prolonged easterly, 225.50 feet from the easterly side of Broadway; thence in a straight line to a point which is 55 feet from the easterly face of the west abutment of the Albany and Greenbush bridge, measured along the line of the northerly truss of said bridge; thence in a straight line to a point in the southerly side of Fourth avenue prolonged easterly, and 215 feet from the easterly or 275 feet from the westerly side of Broadway, said point being in the bulkhead line approved by the Secretary of War March 25, 1890.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
AMOS STICKNEY,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, Washington, D. C.

[First indorsement.]

WAR DEPARTMENT, *May 22, 1903.*

Approved.

E. Root,
*Secretary of War.***F 22.****MODIFICATION OF HARBOR LINES ON WESTERN SHORE OF HUDSON RIVER FROM FORT LEE TO GUTTENBERG, NEW JERSEY.**STATE OF NEW JERSEY, RIPARIAN COMMISSION,
Jersey City, N. J., January 26, 1903.

DEAR SIR: The riparian commission of the State of New Jersey hereby respectfully makes application for the approval by the honorable Secretary of War of the extension of the exterior line for solid filling on the Hudson River, as follows:

Beginning at a point in the present exterior line for solid filling on the westerly shore of the Hudson River 260 feet southeasterly from the stone monument near Tillietudlum pier, at Pleasant Valley landing, and from thence southeasterly, at right angles with said exterior line for solid filling, 300 feet to the present exterior pierhead line; thence southwesterly along and coincident with the present exterior pierhead line to a point opposite the north line of the works of the Valvoline Oil Company, successors to John Ellis & Co., at Edgewater; thence northwesterly, at right angles with said exterior line, 300 feet to the present exterior line for solid filling.

The extension asked for is shown on the map^a hereto annexed and marked "Exterior line for solid filling or piers, adopted December 18, 1902."

The matter of this extension was brought to the attention of the board of riparian commissioners by the application of Mr. John Eisele, who desired to establish an industrial enterprise in the locality in question. Mr. Eisele having acquired a frontage of about 337 feet, as indicated on the map hereto annexed, found that the distance from the shore to the existing solid-filling line was not great enough to make the improvement of the land under water feasible.

In addition to the above fact, the character of the shore, which is high and rocky for a part of the section affected, makes it impracticable to excavate into the land.

The riparian commission respectfully submit that devoting the space between the former solid-filling line and the pierhead line to the depositing of solid filling, where desired, will not prove any detriment to the regimen of the river, as it will be no encroachment on the waterway fixed by the United States Government in 1890.

The riparian commission also respectfully suggests that if the extension of the entire line, as shown on the map hereto annexed, can not be approved at this time, that that portion of the line in front of the property acquired by Mr. Eisele be approved by the honorable Secre-

^a Not printed.

tary of War, inasmuch as the improvements contemplated by Mr. Eisele are delayed and prevented by the conditions now existing.

Respectfully submitted.

THE RIPARIAN COMMISSION OF NEW JERSEY.

JOHN C. PAYNE,

Secretary and Engineer.

Hon. ELIHU ROOT,

Secretary of War, Washington, D. C.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,

U. S. ARMY,

January 30, 1903.

Respectfully referred to Col. Chas. R. Suter, Corps of Engineers, president New York Harbor Line Board, for consideration in connection with papers on this subject referred from this office January 24, 1903.

To be returned.

G. L. GILLESPIE,

Brig. Gen., Chief of Engineers,

U. S. Army.

[Third indorsement.]

NEW YORK HARBOR LINE BOARD,

New York City, February 4, 1903.

Respectfully returned.

The New York Harbor Line Board has carefully considered the within application and sees no public reason for changing the harbor line as requested. It is of opinion that any material change in the lines in the locality in question is inadvisable, and therefore recommends that the application be not favorably considered.

For the Board:

CHAS. R. SUTER,

Colonel, Corps of Engineers,

President Harbor Line Board.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,

U. S. ARMY,

February 7, 1903.

Respectfully returned to Col. Charles R. Suter, Corps of Engineers, president New York Harbor Line Board.

With a view to obtaining the full information on the subject which is required in connection with a presentation to the Secretary of War, it is thought best that a public hearing be granted.

The final report should be a full and exhaustive one.

G. L. GILLESPIE,

Brig. Gen., Chief of Engineers,

U. S. Army.

[Fifth indorsement.]

NEW YORK HARBOR LINE BOARD,

New York City, March 31, 1903.

Respectfully returned to the Chief of Engineers, with the information that a public hearing on this matter was given by the New York

Harbor Line Board on the 12th instant. Attention is invited to the report of the Board of this date, from which it will be seen that in view of the opposition which developed at the hearing to the granting of the riparian commission's request unless the line was extended above and below the points covered by the application, the Board has recommended a modified line, which gives the riparian owners on either side further privileges. This modification, if approved, will substantially give the riparian commission the extension asked for.

For the Board:

CHAS. R. SUTER,
Colonel, Corps of Engineers,
President of the Board.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 3, 1903.

Respectfully returned to the Secretary of War.

The riparian commission of New Jersey requests a modification of the established harbor line on the west shore of Hudson River between Pleasant Valley landing and Edgewater, N. J., by which the bulkhead and pierhead lines would be made to coincide between the points named.

The matter has been under consideration by the New York Harbor Line Board, which held a public hearing on March 12, 1903, at which all parties interested were given an opportunity to be heard.

In view of the opposition which developed at the hearing to the granting of the within request unless the proposed modification should also be extended above and below the points covered by this application, the Board has recommended a modified line which gives the riparian owners on both sides similar privileges. This modification, if approved, will give the riparian commission substantially the extension asked for.

It is recommended that the lines selected by the Board, which are delineated upon the accompanying chart^a and described in the Board's report of the 31st ultimo herewith, be approved by the Secretary of War, and also that the Secretary place his approval upon the tracing^a and description, both of which have been prepared for his signature.

Letters^a from Senators Proctor and Dryden, in the interest of the applicants, are herewith.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

REPORT OF NEW YORK HARBOR LINE BOARD.

HARBOR LINE BOARD,
New York City, March 31, 1903.

GENERAL: In compliance with your indorsement of February 7, 1903, the New York Harbor Line Board gave a public hearing March 12, 1903, on the application of the raparian commission of New Jersey for extension of United States bulkhead line on the westerly shore of the Hudson River between Pleasant Valley landing and Edgewater,

N. J., and has the honor to submit the following report in the matter:

By the stenographer's report^a of this hearing which is inclosed, marked A, it will be seen that there is a general opposition to this extension unless it can be made to include some distance above and below the locality indicated by the riparian commission.

The Board has carefully considered all the facts brought out at the hearing in connection with the natural conditions of the river at the places in question, and finds that immediately north of the extension asked for, at Fort Lee, there begins a public park, and that on the opposite side of the river in New York City are located Riverside Park and Riverside Drive, both public improvements. In view of these facts, it is very unlikely that a general extension of pier lines will be demanded in the localities involved for purposes of commerce by water. The Board has therefore decided to recommend that the bulkhead line covered by the application be modified as shown on the accompanying tracing,^a and believes that such modification, under the conditions named, will not injuriously affect the navigable interests of the harbor.

The modified lines as now recommended are described as follows:

MODIFICATION OF THE BULKHEAD LINE OF THE WEST SHORE OF THE HUDSON RIVER,
FORT LEE TO GUTTENBERG.

Beginning at a point in the pierhead and bulkhead line approved by the Secretary of War July 12, 1900, and February 15, 1902, said point being in a line bearing S. 59° 45' E. from a stone monument near Fort Lee pier south, marked R. C. N. J. 1872, and 670 feet therefrom; thence southerly in a straight line coinciding with the pierhead line approved by the Secretary of War October 18, 1890, to a point in a line bearing S. 59° 15' E. from a stone monument at the east side of the road near Tillietudlum pier, Pleasant Valley landing, and 560 feet therefrom; thence southerly in a straight line coinciding with the aforesaid pierhead line for a distance of 1,800 feet to a point in a line bearing S. 57° 15' E. from the northeast corner of dwelling house, now or formerly, of J. Calvin Smith, near Pleasant Valley landing, and 705 feet therefrom; thence southerly in a straight line coinciding with the aforesaid pierhead line for a distance of 2,750 feet; thence southerly in a straight line and departing from the pierhead line to a point in a line bearing S. 53° E. from the southeast corner of brewery (main building) at Guttenberg and 834 feet therefrom, said point being also in a bulkhead line approved by the Secretary of War April 25, 1890.

Respectfully submitted.

CHAS. R. SUTER,
Colonel, Corps of Engineers.
AMOS STICKNEY,
Colonel, Corps of Engineers.
W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. Army.

[First indorsement.]

WAR DEPARTMENT, April 7, 1903.

Approved.

E. ROOT,
Secretary of War.

^a Not printed.

APPENDIX G.

IMPROVEMENT OF NEW YORK HARBOR; OF BAY RIDGE, RED HOOK, AND BUTTERMILK CHANNELS, AND OF GOWANUS CREEK CHANNEL, NEW YORK; ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK.

REPORT OF MAJ. W. L. MARSHALL, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH OTHER DOCUMENTS, ETC.

IMPROVEMENTS.

- | | |
|---|--|
| 1. New York Harbor, New York.
2. Bay Ridge and Red Hook channels, New York Harbor.
3. Buttermilk channel, New York.
4. Gowanus Creek channel, New York Harbor. | 5. Enlargement of Governors Island, New York Harbor.
6. Removing sunken vessels or craft obstructing or endangering navigation. |
|---|--|
-

UNITED STATES ENGINEER OFFICE,
New York City, July 20, 1903.

GENERAL: I have the honor to submit herewith annual report upon works of river and harbor improvement in my charge for the fiscal year ending June 30, 1903.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Major, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

G 1.

IMPROVEMENT OF NEW YORK HARBOR, NEW YORK.

The title "Improvement of New York Harbor" has been applied to the improvement of the channels of the main entrance from the sea.

A general description of the harbor, of the different channels of the main entrance, and of the projects for improvement is printed in the Annual Report of the Chief of Engineers for 1901, pages 1285-1287.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

MAINTENANCE.

At the beginning of the year the United States dredging steamer *Gedney* was laid up. When the appropriation of 1902 became available the *Gedney* was repaired, painted, and put in order. For three days, August 22–25, she was employed looking for obstructions in main ship channel, off the Perch and Square buoy. She was then moved to a shoal along the south edge of Gedney channel and remained at work there until August 30, when she was transferred to the west side of main ship channel to allow of buoying and protecting the electric-light cables in Gedney channel. Work in Gedney channel was resumed October 11 and completed December 2. From December 3 until the close of the fiscal year the *Gedney* was at work in Ambrose channel on the inner slope of the outer bar and generally near the south edge of the channel.

During the year the *Gedney* has removed 197,384 cubic yards of material, as follows:

From Main Ship channel, 25,615 cubic yards of mud, widening the channel by removing shoals along the west bank between buoys C3 and C5.

From Gedney channel, 60,180 cubic yards, removing shoals along the south edge of the channel between buoys E 5 and E 7.

From Ambrose channel, 111,589 cubic yards.

The working time and lost time during the year were as follows:

	Days.
Laid up prior to July 19	16
Actually working.....	109
Work prevented by weather (fog, storms, etc.).....	114
Occupied in repairs.....	63
Lost, other causes.....	4
Sundays and holidays	59
Total.....	365

In May, 1903, a small group of stones was found in main ship channel close to the head of the Swash channel range; they were removed, and in the final examination a number of large stones were found about 1,000 feet farther south; arrangements are in progress for their removal.

AMBROSE CHANNEL.

At the beginning of the year dredging was in progress under the continuing contract for excavating the channel to 40 feet depth and 2,000 feet width. The contractor found himself unable to reach the amount of excavation required by his contract, 9,600,000 cubic yards per year, and upon his petition and with approval of the Secretary of War a second supplementary contract was entered into, in order to make payments possible if he maintained a rate of 4,000,000 cubic yards of excavation per year. This paper was dated July 14, 1902, and approved by the Acting Secretary of War, August 8, 1902. It specifically provided that the object sought by the United States was to secure the earliest possible completion of the improvement, without increase of cost; that the United States should have the right to further the progress of the work by employing any available plant; and that the added cost of inspection and other contingent expenses result-

ing from the reduced rate of work should be deducted semiannually from payments under the contract.

During the year dredging has been continued by the contractor on the outer side of the sand bar at the outer end of Ambrose channel; 3,556,843 cubic yards of material have been removed during the year, making the total amount under the contract 8,995,620 cubic yards. The channel has been dredged to the full width, 2,000 feet, for about 2,500 feet length, and along the south half it has been extended about a mile farther, with width of 500 to 1,000 feet. The original depths on the bar were about 16 feet at mean low water. The work of the contractor's dredges leaves the bottom very uneven, some shoals remaining with 30 to 35 feet depth, and at some points excavation being carried to 55 feet. The contract does not permit paying for material taken from below the required depth of 40 feet, and frequent examinations are needed to determine the amount to be deducted. During the past year these deductions have been about 17 per cent of the total amount excavated.

Since December 3, 1902, the U. S. dredge *Gedney* has been working on Ambrose channel, along the south edge of the channel and on the inner side of the bar. The dredge has removed 111,589 cubic yards of sand and has deepened the channel from 2 to 4 feet along an irregular section about 2,000 feet long and 400 feet wide.

The cost of operating the *Gedney* in Ambrose channel has been, up to July 1, 14.7 cents per cubic yard of material excavated; the cost for the four months, December to March, was 20.5 cents per yard, and during the months April to June it was 10.7 cents.

Under the appropriation made by the sundry civil act of 1903 it is designed to build two United States dredges for this work, in order to promote its completion.

A joint resolution of Congress, approved July 1, 1902, provides:

That the Secretary of War is hereby authorized and directed to cause to be removed the rock or obstruction in North River of New York Harbor near pier numbered one to a depth of forty feet at mean low tide; and that for such removal he is hereby authorized to divert a sum not exceeding twenty-five thousand dollars from the amounts heretofore appropriated or authorized for the improvement of Ambrose channel, in said harbor.

Little was known about this rock beyond the fact that a steamer had struck against it in February, 1902. A survey was made, which developed a ledge with least observed depth of 28.6 feet at mean low water, with a length of 200 feet at 40 feet depth, and about 1,450 cubic yards volume above that depth. Proposals for removal were invited. The lowest offer received was \$38,000. This was not excessively high in view of the difficulties of work in that location, but as it exceeded the funds available it was necessarily rejected. The ledge could probably be removed to 37 or 38 feet depth with the funds provided, but under a decision of the Comptroller of the Treasury the funds can not be applied to making a depth less than 40 feet. There is no reasonable probability that any responsible contractor will undertake the work for \$25,000, or less, and the execution of the work of removal must therefore await further action of Congress.

PRESENT CONDITION OF IMPROVEMENT.

The improved channels to the sea by way of Sandy Hook have full depth of 30 feet at mean low water, with width of 1,000 feet or more

except at places where shoaling has occurred along the channel banks, limiting the width to between 800 and 1,000 feet.

Ambrose channel has an available depth of about 16 feet at mean low water, the dredging in progress not yet being extended through the crest of the bar.

PROPOSED OPERATIONS.

It is proposed to apply the funds available for maintenance to removing shoals in the improved channels in order to restore and maintain the projected depth, and to apply the funds for Ambrose channel to extending the channel through the outer bar under a continuing contract now in force.

Under the terms of the original and supplementary contracts for excavating Ambrose channel, the contractor should remove 8,000,000 cubic yards between June 30, 1903, and June 30, 1905. He may be able to accomplish this. The U. S. dredging steamer *Gedney* will work in Ambrose channel whenever she can be spared from the work upon maintenance of existing channels; this may be estimated as fifteen months' work before June 30, 1905. Construction and equipment of two United States dredges at cost (estimated in advance) of about \$350,000 each; and operating this plant for one year, two dredges at \$50,000 each. This, with supervision and contingent operating expenses, would amount to:

For contract work	\$720,000
For U. S. dredge <i>Gedney</i>	45,000
For two new dredges	700,000
For operating new dredges	100,000
For contingencies of operation and supervision	85,000
Total	1,650,000

The available funds June 30, 1903, exclusive of outstanding indebtedness, are \$1,060,657.95, therefore the additional appropriation required for the fiscal year ending June 30, 1905, is estimated at \$600,000.

This estimate may be revised when the probable cost of the new dredges and the date of their completion can be determined.

Money statements.

GENERAL IMPROVEMENT.

July 1, 1902, balance unexpended	\$52,113.36
June 30, 1903, amount expended during fiscal year	18,846.47
July 1, 1903, balance unexpended	33,266.89
July 1, 1903, outstanding liabilities	175.00
July 1, 1903, balance available	33,091.89
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	100,000.00

AMBROSE CHANNEL.

July 1, 1902, balance unexpended	\$876, 563. 62
Amount appropriated by sundry civil act approved March 3, 1903	733, 000. 00
	<u>1, 609, 563. 62</u>
July 1, 1902, joint resolution of Senate and House diverting from appropriation for Ambrose channel, sundry civil act, June 28, 1902, for removal of obstruction in North River	\$25, 000. 00
June 30, 1903, amount expended during fiscal year	298, 516. 60
	<u>323, 516. 60</u>
July 1, 1903, balance unexpended	1, 286, 047. 02
July 1, 1903, outstanding liabilities	225, 389. 07
	<u>1, 060, 657. 95</u>
July 1, 1903, balance available	<u>3, 015, 396. 00</u>
July 1, 1903, amount covered by uncompleted contracts	<u>1, 987, 000. 00</u>
(Amount (estimated) required for completion of existing project	1, 987, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	600, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

REMOVAL OF OBSTRUCTION IN NORTH RIVER.

Amount diverted from appropriation for Ambrose channel, sundry civil act, June 28, 1902, joint resolution of Senate and House, July 1, 1902..	\$25, 000. 00
June 30, 1903, amount expended during fiscal year	<u>549. 75</u>
July 1, 1903, balance unexpended	<u>24, 450. 25</u>

Appropriations for improving New York Harbor have been made as follows:

Application.	Date.	Amount.
For Gedney channel, dredging via Sandy Hook	July 5, 1884	\$200, 000. 00
For New York Harbor	Aug. 5, 1886	750, 000. 00
Do	Aug. 11, 1888	830, 000. 00
Do	Sept. 19, 1890	160, 000. 00
Do	July 13, 1892	170, 000. 00
Do	Aug. 18, 1894	75, 000. 00
Do	June 3, 1896	60, 000. 00
Do	Mar. 3, 1899	100, 000. 00
Do	June 13, 1902	50, 000. 00
		<u>1, 945, 000. 00</u>
Received from other sources		28, 024. 52
Total		<u>1, 973, 024. 52</u>
For East (Ambrose) channel, dredging	Mar. 3, 1899	1, 000, 000. 00
Do	Mar. 3, 1901	130, 000. 00
Do	June 28, 1902	150, 000. 00
Do	Mar. 3, 1903	733, 000. 00
Total		<u>2, 013, 000. 00</u>
Amount diverted by joint resolution July 1, 1902, for removal of rock in North River		25, 000. 00
		<u>1, 988, 000. 00</u>

CONTRACT IN FORCE DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

With Andrew Onderdonk, of New York, N. Y., for excavating in East (Ambrose) channel, New York Harbor, and removing about 42,500,000 cubic yards of material at a rate of 9 cents per cubic yard, date of contract, May 12, 1899, approved by the Chief of Engineers May 24, 1899, supplemental articles of agreement dated July 18, 1901, and July 14, 1902, approved by the Acting Secretary of War August 5, 1901, and August 8, 1902, providing for beginning work July 1, 1901, instead of May 24, 1900, and for making payments when the rate of excavation is 4,000,000 yards per

year, instead of 9,600,000 yards, the United States to have the right to further the rate of progress at any time and with any plant which can be obtained; date of expiration of contract indefinite, depending upon appropriations by Congress.

COMMERCIAL STATISTICS.

The following statement concerning foreign commerce of the port of New York is compiled from the annual report of the Chamber of Commerce of New York for the year 1902-3. It comprises only imports from and exports to foreign countries, and does not include the domestic, coastwise, and local traffic. Vessels trading with domestic ports are not required to take out clearance papers, and no statistics of their carrying trade are accessible.

The leading articles of import into the United States at the port of New York for the year ending June 30, 1902, were sugar, molasses, coffee and tea, wool, cloths and dress goods, leather and leather goods, tin, rubber, and tobacco, with other miscellaneous imports, aggregating about 3,524,561 tons, valued at \$574,066,854.

The value of such imports for all other ports of the United States for the same period was \$409,507,602.

The leading articles of export were cotton, breadstuffs, and other provisions, oils, tobacco, metals, and manufactures, which, with miscellaneous items, aggregated about 6,432,384 tons, valued at \$570,962,457.

The value of such exports for all other ports of the United States for the same year was \$909,058,284.

Statement of the number and tonnage of all vessels belonging to the port of New York, June 30, 1902.

	Number.	Tonnage.
Sailing vessels	1,382	283,272
Steam vessels	1,307	665,865
Canal boats	226	28,829
Barges	1,136	269,862
Total	4,051	1,247,828

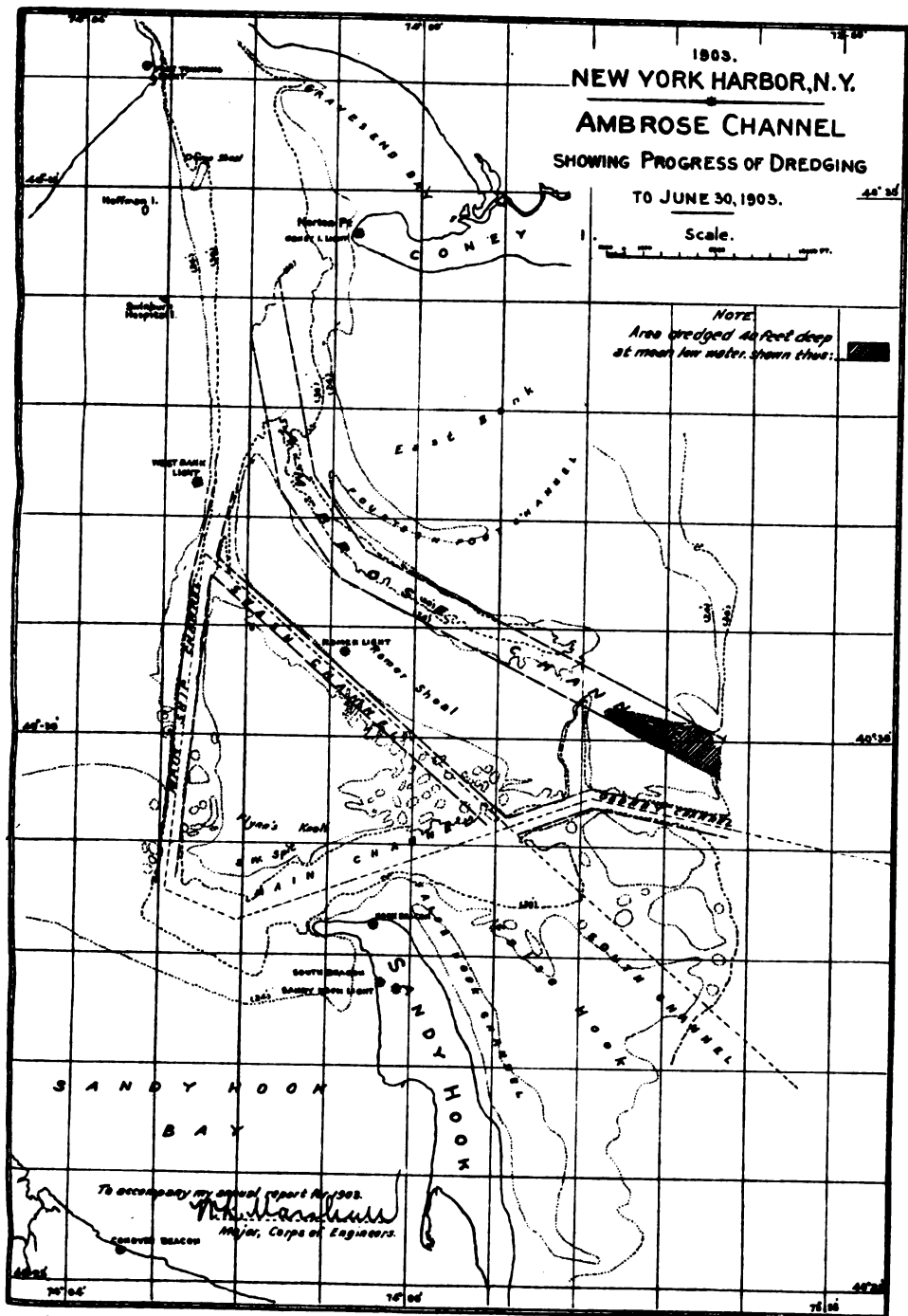
From the records of the New York and New Jersey pilot commissioners the following data concerning deep-draft vessels crossing Sandy Hook bar have been compiled for the calendar year 1902:

Draft.	Leaving.		Arriving.	
	Number of vessels.	Number of trips.	Number of vessels.	Number of trips.
32 feet and over	2	3		
31 feet and under 32 feet	8	20		
30 feet and under 31 feet	17	43		
29 feet and under 30 feet	35	92		
28 feet and under 29 feet	53	155	5	10
27 feet and under 28 feet	73	189	11	36
Total		502		46

The total number of different vessels of 27 feet draft or over is 104.

The maximum draft of vessels leaving the harbor in 1902 was 32 feet 8 inches; in February, 1903, a ship is reported going out with draft of 33 feet 1 inch. The maximum draft of vessels entering the harbor was 28 feet 4 inches. Vessels leaving the harbor are of greater draft than those entering, having a full supply of coal and generally carrying heavier freights.

Before the improvement of Gedney channel vessels drawing 27 feet could cross the bar only at extreme high tide.



G 2.

IMPROVEMENT OF BAY RIDGE AND RED HOOK CHANNELS, NEW YORK HARBOR.

These channels on the east side of New York Harbor are designed, under the existing project for making them 40 feet deep at mean low water and 1,200 feet wide, to afford a deep-water approach to the wharves along the South Brooklyn shore.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

At the beginning of the year dredging was in progress under continuing contract for excavation of the entire channel. Work was continued during the year, with partial suspension during the months of December, January, February, and March, and 2,354,555 cubic yards of mud and sand were removed, making the total excavation June 30, 1903, 4,877,079 cubic yards.

The work done has been mainly in Bay Ridge channel. From the 40-foot curve at the lower end to Eightieth street, a distance of about 3,600 feet, the natural depth is 35 feet and little dredging has yet been done; from Eightieth street to Bay Ridge avenue, 3,000 feet, about two-thirds the width of the channel has been dredged; from Bay Ridge avenue to Forty-fourth street, 5,200 feet, nearly the whole width has been dredged, and from Forty-fourth street to Erie Basin, 3,000 feet, the channel has been excavated for a little more than one-half its width; two cuts have been made in Red Hook channel.

The depths made are very irregular, partly on account of the varying character of material, but largely resulting from the contractors' inability to keep the dredges on range.

The plant has consisted of two bucket dredges adapted to dredging mud and one suction dredge fitted for work in sand; the contractors have another suction dredge building, from which they expect important results; it is expected to be ready to work in July, 1903.

Under the terms of the contract no payment becomes due the contractors unless they maintain a rate of excavation equal to 300,000 cubic yards per month for ten months of the year. No payment has been made since February, 1903, and it is not anticipated that any will become due until the new dredge is in successful operation.

PROPOSED OPERATIONS.

With the available funds and with future appropriations it is proposed to continue dredging Bay Ridge and Red Hook channels under the authorized continuing contract for completing the project.

The estimated amount which will be required under the contract for the fiscal year ending June 30, 1905, is \$226,000. It is estimated that the total amount excavated by that date may be about 11,000,000 cubic yards, which, at 10 cents per yard, would amount to \$1,100,000. The amount already appropriated for this project is \$874,000, and the difference is believed to be sufficient to pay all obligations which will be incurred and become due up to June 30, 1905, including contingent expenses.

These channels are in the collection district of New York, of which

New York City is the port of entry. The nearest light-house is the Statue of Liberty Enlightening the World, on Bedloes Island, about $1\frac{1}{2}$ miles west. The nearest work of defense is Fort Columbus, Governors Island, New York Harbor.

Money statement.

July 1, 1902, balance unexpended.....	\$416, 276. 48
Amount appropriated by sundry civil act approved March 3, 1903.....	272, 000. 00
	688, 276. 48
June 30, 1903, amount expended during fiscal year.....	191, 497. 18
	496, 779. 30
July 1, 1903, balance unexpended	496, 779. 30
July 1, 1903, outstanding liabilities.....	111, 452. 58
	385, 326. 72
July 1, 1903, balance available	385, 326. 72
July 1, 1903, amount covered by uncompleted contracts.....	1, 710, 292. 10
	1, 626, 000. 00
(Amount (estimated) required for completion of existing project.....	1, 626, 000. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	226, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

Appropriations for improving Bay Ridge and Red Hook channels, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.
Dredging.....	Mar. 4, 1881	\$40, 000
Do	Aug. 2, 1882	20, 000
Do	July 5, 1884	5, 000
Do	Aug. 5, 1886	7, 500
Do	Aug. 11, 1888	60, 000
Do	Sept. 19, 1890	160, 000
Do	July 13, 1892	198, 600
Do	Aug. 18, 1894	150, 000
Do	June 3, 1896	a 530, 000
Do	June 4, 1897	
Do	July 1, 1898	
Total.....		b 1, 171, 100

^a These three appropriations, aggregating \$680,000, were applied under continuing contract to dredging Bay Ridge, Red Hook, and Buttermilk channels. It is estimated that about \$530,000 were applied to Bay Ridge and Red Hook channels.

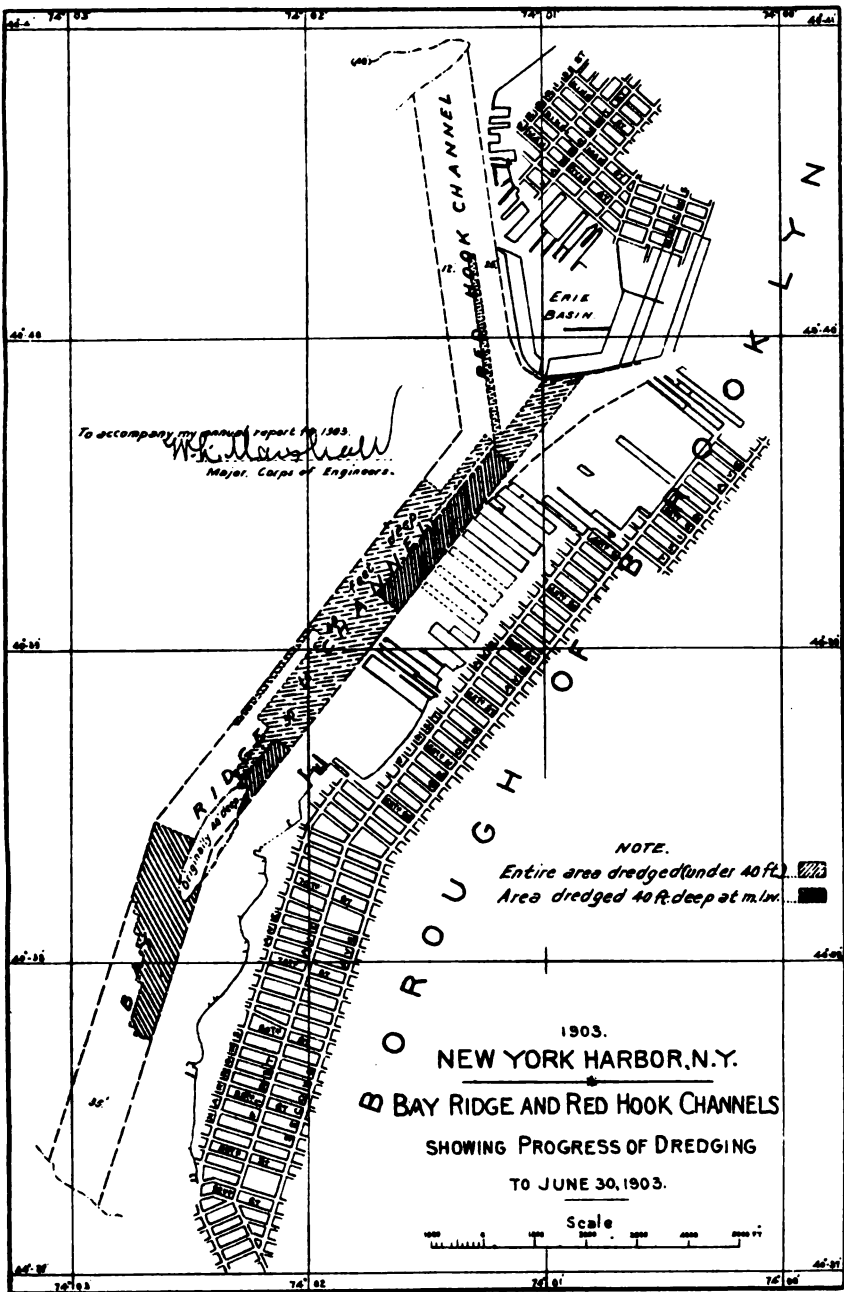
^b This total includes small sums applied to dredging in Gowanus Canal, the amounts of which are not definitely known.

For present project of 1899.

Application.	Date.	Amount.
Dredging.....	Mar. 3, 1899	\$100, 000
Do	June 6, 1900	262, 000
Do	Mar. 3, 1901	140, 000
Do	June 28, 1902	100, 000
Do	Mar. 3, 1903	272, 000
Total.....		874, 000

CONTRACT IN FORCE.

For excavating Bay Ridge and Red Hook channels, 1,200 feet wide and 40 feet deep at mean low water, removing 22,000,000 cubic yards, more or less, at 10 cents per cubic yard, measured in scows.



Name of contractor, Hughes Bros. & Bangs, of Syracuse, N. Y.; date of contract, July 31, 1899, and supplemental contract dated May 7, 1902, providing for beginning work November 1, 1901, instead of May 14, 1900; expiration of contract, indefinite, depending upon appropriations by Congress. Work in progress.

COMMERCIAL STATISTICS FOR THE CALENDAR YEAR 1902.

Freight received and shipped by water.

	Approximate amount.	Estimated value.
Bay Ridge channel (Ninety-second street to Twenty-eighth street)	<i>Tons.</i>	
Receipts	1,400,000	\$50,000,000
Shipments	800,000	40,000,000
Red Hook channel (Henry street to Red Hook), no commerce reported except that of Erie Basin:		
Receipts	1,500,000	35,000,000
Shipments	1,500,000	40,000,000
Total	5,200,000	165,000,000

Vessels, not including tugs or ferryboats.

	Number.	Draft.	Tonnage.
		<i>Feet.</i>	<i>Tons.</i>
Steamers, sail vessels, and barges	12,000	5 to 23½	50 to 12,000

The above includes only freight received and shipped at the docks. In addition about 3,000,000 tons of freight pass through these channels to and from Gowanus Creek.

Other freights pass through these channels to various destinations, the amounts of which there is no means of estimating.

It is impracticable to obtain accurate data of the amounts of freight handled in the various parts of New York Harbor, no complete records being kept. This statement is prepared from the best data obtainable, and is believed to afford a fair idea of the amount and value of commerce in these channels.

G 3.

IMPROVEMENT OF BUTTERMILK CHANNEL, NEW YORK HARBOR.

The improvement of this channel was begun in 1880. In 1896 it was consolidated with the improvement of Bay Ridge and Red Hook channels, under a project completed in 1899. Since that time it has been considered separately.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

The project for this improvement, adopted under the appropriation made by the river and harbor act of June 13, 1902, was approved July 3, 1902, and consists in deepening the eastern side of the channel to 30 feet at mean low water, with a width as great as the available funds will permit and estimated at about 400 feet.

After due advertisement, proposals were received September 3,

1902. The lowest offer received was at the rate of 36 $\frac{1}{2}$ cents per cubic yard. It was considered too high, and all the proposals were rejected. The conditions of coal supply at this time were unsettled and the prices of fuel were unusually high, therefore it was decided to defer re-advertising until 1903. Proposals were again invited and received April 20, 1903. A contract for dredging was entered into with William H. Taylor, of Jersey City, N. J., under date of April 20, 1903, approved by the Chief of Engineers May 11, 1903, for removing about 300,000 cubic yards of material, at the rate of 26 cents per cubic yard.

On May 30, 1903, when the contractor was about ready to begin work, fire destroyed a part of his plant, including the dredge which was best fitted for work in Buttermilk channel. It is expected that work will be begun in August.

PRESENT CONDITION OF IMPROVEMENT.

Buttermilk channel has been made 26 feet deep at mean low water by removing the shoals (of less than that depth) to a width of 1,000 feet. It retains that depth generally, except on the west side near the upper end, where an eddy of slack water at the convergence of the Buttermilk channel and East River tides causes a deposit of soft sand.

PROPOSED OPERATIONS.

Under the existing contract it is proposed to make Buttermilk channel 30 feet deep at mean low water throughout its entire length and for a width of about 400 feet along the easterly edge of the channel, completing the adopted project.

Money statement.

July 1, 1902, balance unexpended	\$90,000. ⁽¹⁾
June 30, 1903, amount expended during fiscal year	97.41
July 1, 1903, balance unexpended	89,902. ⁵⁹
July 1, 1903, amount covered by uncompleted contracts	80,000. ⁽¹⁾

Appropriations for improving Buttermilk channel, New York Harbor, have been made as follows:

For previous projects.

Application.	Date.	Amount.
Dredging	June 14, 1880	\$60,000
Do	Mar. 4, 1881	60,000
Do	Aug. 2, 1882	60,000
Do	July 6, 1884	30,000
Do	Aug. 5, 1886	56,250
Do	Aug. 11, 1888	100,000
Do	July 13, 1892	100,000
Do	Aug. 18, 1894	50,000
Do	June 3, 1896	150,000
Do	June 4, 1897	
Do	July 1, 1898	
Received from other sources		100
Total		646,350

^a Part of three appropriations for improving Bay Ridge, Red Hook, and Buttermilk channels, aggregating \$680,000, of which it is estimated about \$150,000 was applied to Buttermilk channel.

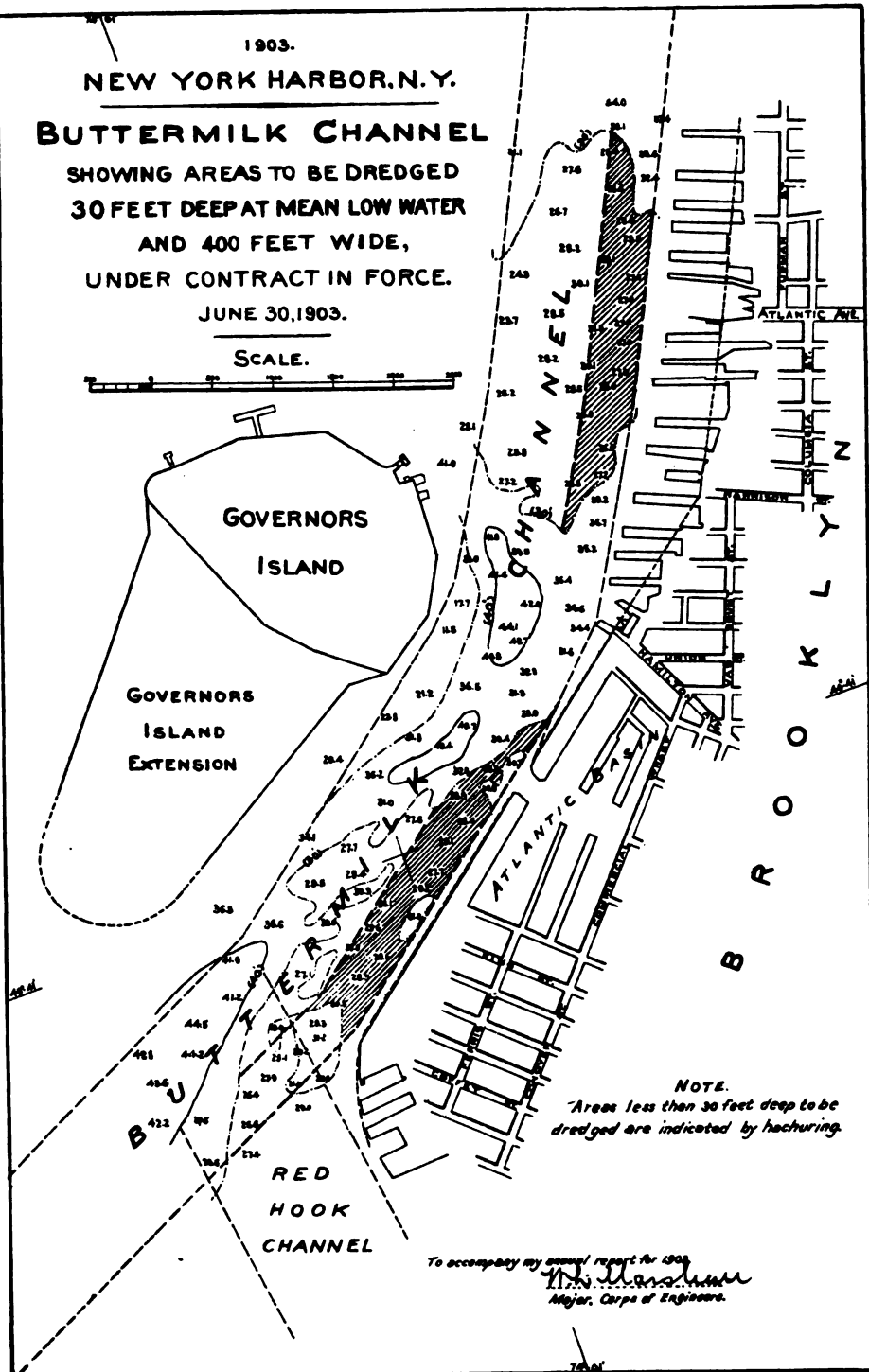
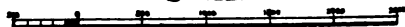
1903.
NEW YORK HARBOR, N.Y.

BUTTERMILK CHANNEL

SHOWING AREAS TO BE DREDGED
30 FEET DEEP AT MEAN LOW WATER
AND 400 FEET WIDE,
UNDER CONTRACT IN FORCE.

JUNE 30, 1903.

SCALE.



NOTE.
Areas less than 30 feet deep to be dredged are indicated by hachuring.

To accompany my annual report for 1903

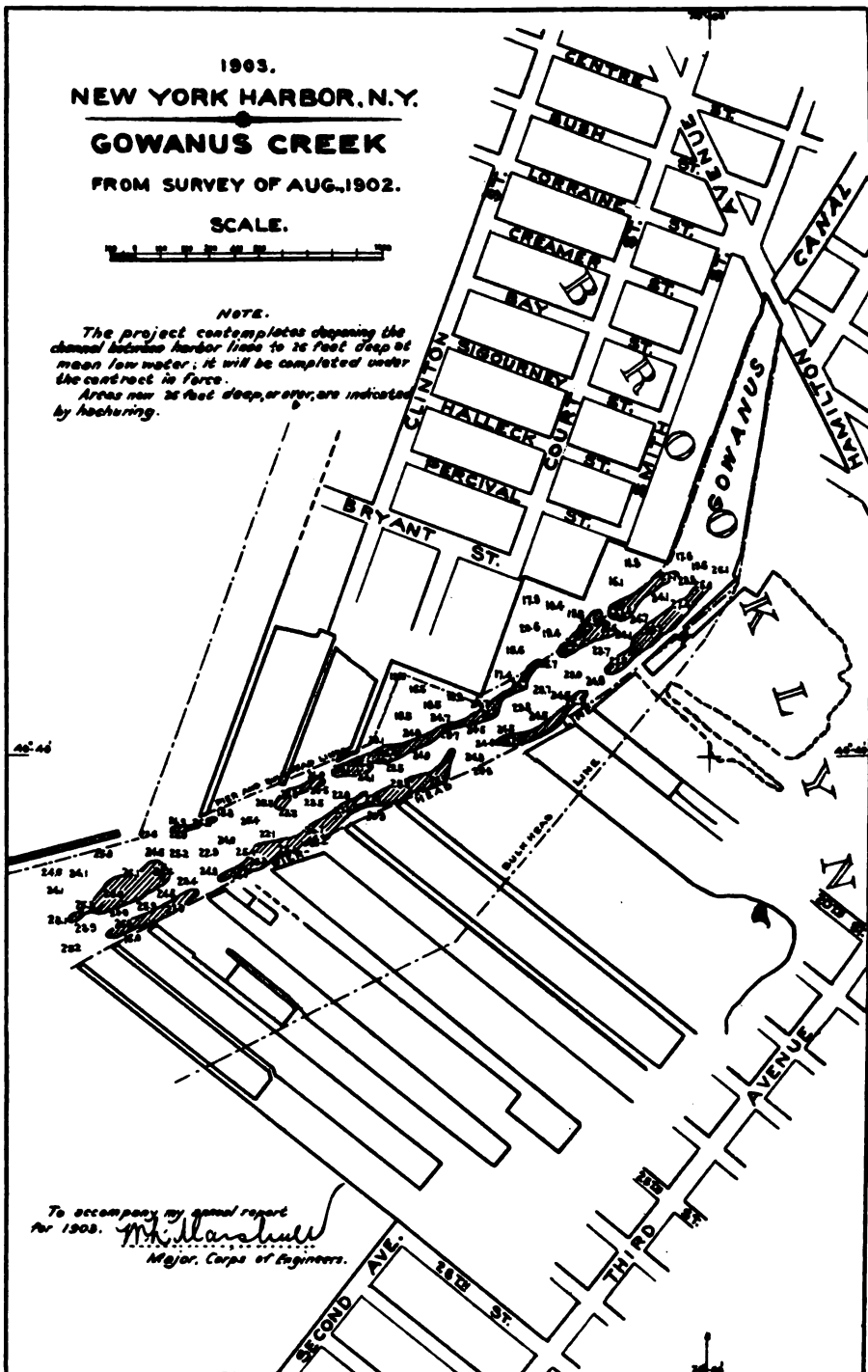
W. H. Marsh
Major, Corps of Engineers.



1903.
NEW YORK HARBOR, N.Y.
GOWANUS CREEK
FROM SURVEY OF AUG., 1902.



NOTE.
The project contemplates deepening the channel between harbor lines to 26 foot deep at mean low water; it will be completed under the contract in force.
Areas now 26 foot deep, or over, are indicated by hachuring.



To accompany my annual report
for 1903. *W. Marshall*
Major, Corps of Engineers.

For project of 1902.

Application.	Date.	Amount.
Not yet expended	June 13, 1902	\$90,000

CONTRACT IN FORCE FOR IMPROVING BUTTERMILK CHANNEL.

Dredging:

Name of contractor: William H. Taylor.

Date of contract: April 30, 1903.

Date of approval: May 11, 1903.

Date for completion: January 4, 1904.

Quantity: 300,000 cubic yards, at 26 cents per cubic yard.

Work not yet begun.

COMMERCIAL STATISTICS.

Statistics for the calendar year of 1902 have not been collected in detail.

In 1899 the amount of freights received and shipped was 16,587,000 tons, valued at \$658,384,823. It was carried in 45,849 vessels, of various drafts up to 29 feet and tonnage up to 6,800 tons. Details are printed in the Annual Report of the Chief of Engineers for 1900, page 1468.

The present commerce of Buttermilk channel is about the same in amount as the commerce of 1899.

G 4.

IMPROVEMENT OF GOWANUS CREEK CHANNEL, NEW YORK.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

Under the appropriation of \$20,000 made by the river and harbor act of June 13, 1902, a project for expenditure was approved, providing for completing the improvement by removing shoals from the channel and widening it out to the harbor lines as nearly as possible, making the depth 26 feet at mean low water.

Proposals for dredging were received September 3, 1902. The lowest offer was at the rate of 21½ cents per cubic yard, which was considered too high, and all the proposals were rejected. On account of the high prices of coal and unsettled conditions of market it was decided to defer readvertising until 1903. April 20, 1903, proposals were again received, and a contract for dredging about 91,139 cubic yards of material, at rate of 19½ cents per yard, was entered into with William H. Taylor, of Jersey City, N. J. Owing to the partial destruction of the contractor's plant by fire May 30, 1903, the beginning of work has been delayed. It is expected that excavation will be begun in August.

PRESENT CONDITION OF CHANNEL.

The channel has been dredged to 26 feet depth at mean low water for its full length and with width extending to within 15 feet of the pier lines on either side. It can not be widened to the pier lines without endangering the pierheads. The middle part, 125 feet wide, has shoaled about 3 feet by deposition of soft mud. The sides, more recently dredged, retain nearly the depth of 26 feet.

PROPOSED OPERATIONS.

The appropriation of 1902, made for completing the projected improvement, will be applied to that object, which, it is believed, will be accomplished during the next fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$20,000.00
June 30, 1903, amount expended during fiscal year	39.49
July 1, 1903, balance unexpended	19,960.51
July 1, 1903, amount covered by uncompleted contracts	18,000.00

Appropriations for improving Gowanus Creek channel, New York Harbor, have been as follows:

Application.	Date.	Amount.
For previous projects: Parts of the appropriations for Gowanus Bay channels, applied to Gowanus Creek, estimated to amount to about \$75,000, dredging to 21 feet depth.	Mar. 3, 1881, to July 13, 1892.	\$75,000
For the present project:		
Dredging 26 feet deep	June 3, 1896	25,000
Do	Mar. 3, 1899	25,000
Do	June 13, 1902	20,000
Total		145,000

COMMERCIAL STATISTICS.

There is no material change in the amount of commerce of Gowanus Creek since 1899, when a careful compilation showed the amount of freights received and shipped to be 237,300 tons, valued at \$3,048,390; this freight was carried in 5,065 vessels of draft from 5 to 25 feet and tonnage from 50 to 3,000.

The above refers to freight handled at the Gowanus Creek docks. About 2,500,000 tons of freight in addition passed into or through Gowanus Creek without unloading.

Details of this commerce are printed in the Annual Report of the Chief of Engineers for 1900, page 1471.

G 5.

ENLARGEMENT OF GOVERNORS ISLAND, NEW YORK HARBOR.

This project was adopted under authority of the sundry civil act of March 3, 1901, and consists in enlarging the island by reclaiming land under water on the shoal southwest of the island, inclosing the enlargement by a sea wall, building a dock on the north shore of the island, and deepening the approach to the dock, and constructing buildings for military uses.

The enlargement proper, the dock building and dredging, estimated to cost \$885,000, were assigned to the Engineer Department.

The original plan for reclaiming 82 acres of land was extended to 101 acres by approval of Secretary of War. No increase in the estimated cost appears necessary as yet.

OPERATIONS DURING THE FISCAL YEAR ENDING JUNE 30, 1903.

1. *Construction of pile wharf.*—At the beginning of the year the contract for this work was nearly completed; the dock was finished

August 6, 1902. The T-head measurements, over all, are 373½ feet length by 50½ feet breadth. The approach is 180 feet long and 40 feet wide. Its total cost to the United States, exclusive of inspection, was \$27,126.38, divided up approximately as follows:

	Per cent.
Piles driven.....	35
Yellow-pine timbers, braces, and flooring.....	54
Bolts, spikes.....	6
Mooring posts, cleats, tar paper, and miscellaneous.....	5

2. *Dredging in front of wharf.*—July 1, 1902, this work was nearly completed. During July 606 cubic yards of material were removed, including one boulder of about 19 cubic yards volume, completing the contract. The total amount excavated and removed under the contract was 70,550 cubic yards.

During the dredging a small ledge was uncovered near the east end of the dredged area, having a least depth of 20.6 feet, and estimated to contain about 35 cubic yards above the plane of 26 feet depth. A contract was made for its removal.

3. *Riprap bulkhead.*—This consists of a substructure rising to about 2 feet above low water and with 12 to 15 feet top width, on which it is designed ultimately, and after the riprap has settled, to build an upper wall to retain the embankment. July 1, 1902, this bulkhead was being built under contract for delivery of about 142,000 tons of riprap at 35 cents per ton. This was sufficient for finishing the southeast bulkhead, 2,230 feet long, along Buttermilk channel, and for building about 700 linear feet of the northwest bulkhead. The price was exceptionally low, and when additional funds became available from a decision to postpone erecting a steel shed on the new wharf, supplementary articles of agreement were entered into to provide for placing additional stone at the same price and for completing the northwest bulkhead out to the limits of the grant of land under water. This contract was completed May 5, 1903.

During the fiscal year 89,079 tons of riprap were delivered, making a total amount of 217,975 tons.

By act of the legislature of the State of New York, approved March 6, 1903, the commissioners of the land office were authorized to issue to the United States a further grant of land under water, to admit of the additional extension of the island. The grant was issued by letters patent dated June 5, 1903.

After advertising for proposals, a contract was entered into with John D. Miller for delivering about 160,000 tons of riprap and completing the bulkhead as far as could be done to advantage, leaving an opening for vessels to enter and bring material for embankment. The price of this riprap is 58 cents per ton. The favorable conditions which secured a price of 35 cents in 1901 no longer exist. Work under this contract will begin early in July.

The pile platform carrying light and fog bell near the outer end of northwest bulkhead was run into by a car float on the night of January 30, 1903. The night was clear and the light was burning. The platform was wrecked beyond repair. Instead of rebuilding it, a small schooner was hired and anchored near the end of the bulkhead, and the fog bell and light were operated from the schooner.

Intercepting sewers.—Several small sewers and drains from buildings on the southwest side of the island discharged through the sea wall into the area between the bulkheads, where they would be closed by

the embankment. To provide for the removal of the sewage, two intercepting sewers were built, discharging, respectively, into Butter-milk channel and into the North River current near Castle Williams. The work was done by hired labor; the sewers were completed and in satisfactory operation in January, 1903; the trench was finally graded and sown with grass seed in the spring and the work turned over to the commanding officer at Fort Columbus.

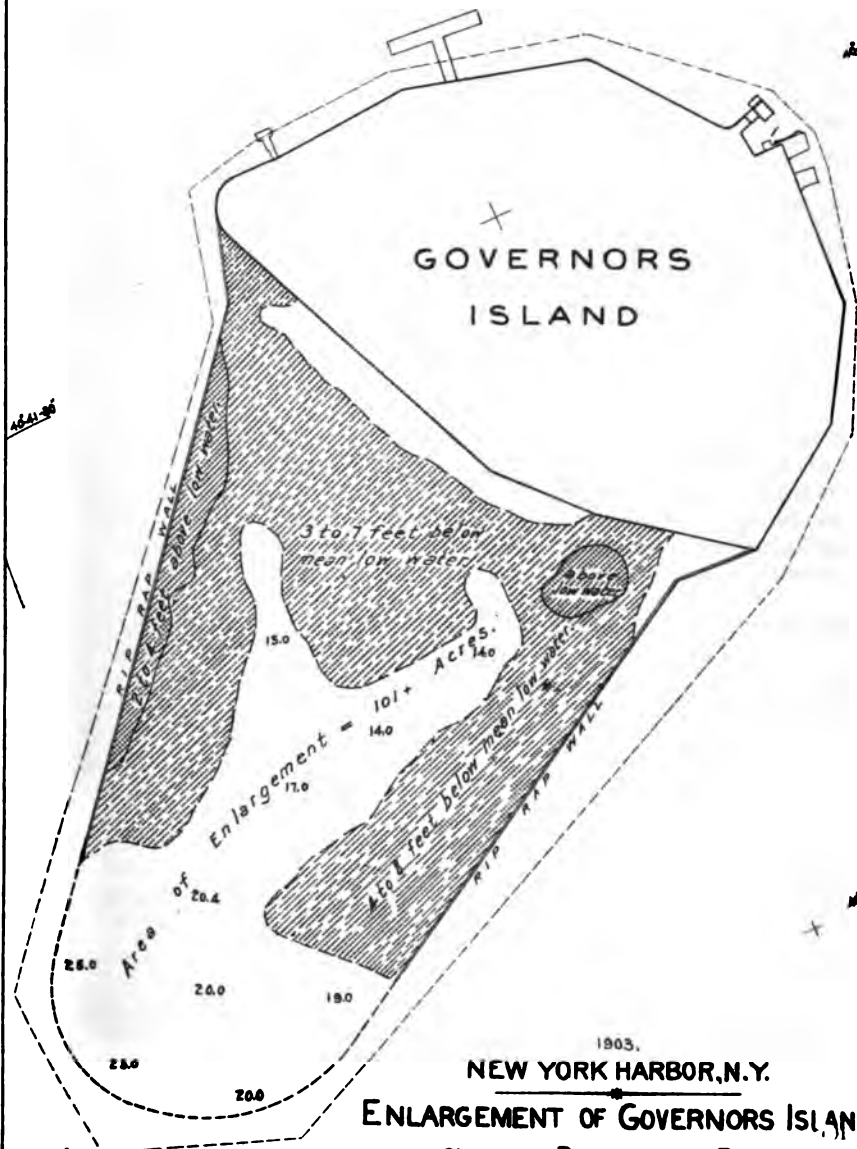
Embankment behind bulkhead.—When the side bulkheads were nearly completed proposals were invited for sand and similar materials for embankment. Before the proposals were opened it was ascertained that under existing conditions lower prices could be obtained if mud filling in a small proportion was not wholly excluded. By order of the Chief of Engineers, the proposals were rejected and the work readvertised. Under date of December 24, 1902, a contract was entered into with the New York Filling Company for delivering and placing material of class 1 (sand, ashes, and other clean, hard material exclusively), at the rate of 7.4 cents per cubic yard, and material of class 2 (being the same with not exceeding 50 per cent of mud), at 3.6 cents per cubic yard. The contract provides that the material shall be brought up to the level of the top of the bulkhead, 2 feet above mean low water, thence sloped backward with a rise of 1 on 8 for a height of 10 feet, and then with a further rise of 1 on 200, making the maximum height along the crest from 13 to 15 feet. It is estimated that about 40 per cent of the whole fill will be above the level of mean low water. This part requires rehandling, which is the only expensive feature of the work to the contractors; therefore a provision was included in the specifications to the effect that no material below water should be paid for until at least two-thirds as much was placed above low-water level. The contractors began work in January, and up to the close of the fiscal year have delivered 836,668 cubic yards of material, of which 46,985 yards are above low-water level. Their plant for rehandling material consists of one pump and three dipper dredges. The area above low water is a strip along the North River bulkhead about 1,700 feet long and from 40 to 150 feet wide, and a detached island in the east side of the inclosure, nearly opposite South Battery; the total area is about 5 acres, and the height ranges from 1 to 5 feet. This filling is hard and dries out readily, scarcely any mud appearing on the surface.

PROPOSED OPERATIONS.

With the available funds the riprap foundation for the sea wall will be completed, except an opening of 300 to 350 feet width, which should not be closed until the embankment is nearly completed; work on the embankment will be continued and about one-third the filling completed under contract now in force; a contract will be entered into for building a masonry sea wall on the riprap, and it is estimated that the funds will suffice to build from 2,500 to 3,000 linear feet of sea wall; the total length, when completed, will be about 7,130 feet.

Future appropriations will be applied to completing the embankment, to covering it with loam, and to continuing the sea wall around the inclosure.

GOVERNORS ISLAND



1903.
NEW YORK HARBOR, N.Y.

ENLARGEMENT OF GOVERNORS ISLAND SHOWING PROGRESS OF FILLING.

TO JUNE 30, 1903.

Scale.



To accompany my annual report for 1903.

W. H. H. H.
Major, Corps of Engineers.

Area filled above mean low water shown by hatching
• of filling below m.l.w. shown by broken hatching.

Money statement.

July 1, 1902, balance unexpended	\$290,506.01
Amount appropriated by sundry civil act approved March 3, 1903	150,000.00
	440,506.01
June 30, 1903, amount expended during fiscal year	76,654.26
July 1, 1903, balance unexpended	363,851.75
July 1, 1903, outstanding liabilities	42,626.09
	321,225.66
July 1, 1903, balance available	180,742.65
July 1, 1908, amount covered by uncompleted contracts	475,000.00
{ Amount (estimated) required for completion of existing project	475,000.00
{ Amount that can be profitably expended in fiscal year ending June 30,	
1905, in addition to the balance unexpended July 1, 1903	200,000.00
{ Submitted in compliance with requirements of sundry civil act of June	
4, 1897.	

The enlargement proper, estimated to cost \$885,000, and the dock building and dredging, estimated at \$215,000, were assigned to the Engineer Department. The last two items were completed at \$60,000 less than the estimated cost, which amount from the first appropriation was applied to the enlargement proper. Subsequent appropriations, \$350,000, applied to the same work, make the present estimated cost of completion \$475,000.

The appropriations made for this work, as far as relates to the Engineering Department, are as follows:

Sundry civil act of March 3, 1901, \$260,000, of which \$200,000 were allotted to Engineer Department; general deficiency act of July 1, 1902, \$200,000; and sundry civil act of March 3, 1903, \$150,000; total, \$550,000.

CONTRACTS IN FORCE.

Dredging:

Name of contractor: R. G. Packard Company, 130 Pearl street, New York City.

Date of contract: October 12, 1901.

Date of approval: October 31, 1901.

Date of completion: July 31, 1902.

Extension of contract: Time of completion waived for a period of two months (authority of Chief of Engineers), or July 11, 1902.

Building pile dock:

Name of contractor: Rosevelt & Sullivan, 80 New street, New York City.

Date of contract: October 12, 1901.

Date of approval: October 25, 1901.

Date of completion: August 6, 1902.

Total cost of construction: Approximately, \$25,362.16.

Extension of contract: Time of completion waived by authority of Chief of Engineers for a reasonable period.

Building riprap bulkhead:

Name of contractor: Brown & Fleming, 129 Broad street, New York City.

Date of contract: November 12, 1901.

Date of approval: November 27, 1901.

Date of beginning: December 17, 1901.

Date of completion: May 5, 1903.

Quantity: 142,000 tons, at 35 cents per ton.

Extension of contract: Time of completion waived for two months from June 21, 1902, or August 21, 1902.

Building embankment:

Name of contractor: New York Filling Company, New York City.

Date of contract: December 24, 1902.

Date of approval: January 12, 1903.

Date of completion: Indefinite.

Building riprap bulkhead:

Name of contractor: John D. Miller, 39 Cortlandt street, New York City.

Date of contract: May 5, 1903.

Date of approval: June 10, 1903.

Date of completion: October 27, 1904.

Removal of rock:

Name of contractor: R. G. Packard Company, 130 Pearl street, New York City.

Date of contract: December 4, 1902.

Date of approval: December 27, 1902.

Date of completion: April 15, 1903.

G 6.
REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Barges Lichtenfels Bros., Ringleader, and P. J. Carleton.—These were large barges, with cargoes of soft coal, sunk in the Lower Bay in February and March, 1902. Contracts for removal were made, and at the date of the last annual report the removal was nearly completed.

The barges *Ringleader* and *Carleton* were lifted, towed away, and placed close under the east shore of Rikers Island, East River, and back of the harbor lines. The *Ringleader* was first placed too far from shore, and the contractors were required to move her again. Final examination, made August 1, 1902, showed that they were placed where they were not liable to escape into the channel.

The *Lichtenfels* was broken to pieces and the several pieces taken up and deposited on docks and on shore above high-water mark; its removal was completed September 4, 1902.

Schooner John Comstock.—This was a small vessel about 53 feet long, built in 1849. In July, 1902, she sprung a leak and sank in 26 feet of water in the dredged channel of Gowanus Creek, New York Harbor, nearly in front of the Rogers docks. After some attempts at raising her she was abandoned by the owner.

Allotment for removal was made, proposals invited, and the lowest offer received was accepted—that of John F. Baxter, for \$243, less \$1 for purchase of the hull and contents.

The wreck was raised and towed to Weehawken, N. J., where an inspection, made October 10, 1902, showed that it had been deposited hard aground in water 2 to 3 feet deep at low tide and behind the bulkhead line.

The vessel had no cargo and the hull was worthless.

Canal boat off Tompkinsville, New York Harbor.—This obstruction consisted of the side and end of a canal boat which had been drifting along the Staten Island shore, and which early in September, 1902, grounded in 24 feet of water, in front of the ferry landing at Tompkinsville.

An allotment for removal was made, and after inviting proposals the offer of the Hudson River Lighterage Company to remove the obstruction for \$150 was the lowest offer received, and was accepted.

The wreck was lifted and placed upon McRoberts's coal dock, at Tompkinsville, where it was subsequently cut up for firewood. It was found to consist of one side and end of a canal boat about 60 feet long. There was no name remaining or other marks by which the boat could be identified.

Minor obstructions removed by the U. S. S. Manisees without cost to the United States.—Captain Martin, of the steamer *Sandy Hook*, reported striking a submerged obstruction in main ship channel, off Southwest Spit. It was found to consist of broken spar buoy, with chain and stone attached. It was taken up August 22, 1902, and turned over to the light-house station at Tompkinsville.

November 17, 1902, part of a deck scow was found floating in the channel off Hoffman Island. It was towed to Staten Island and pushed ashore. The piece was 35 feet wide, the full width of the scow, and 12 feet long, and all the timbers had been sawed off evenly. There were no marks by which it could be identified.

April 10, 1903, a corner of a car float was found floating and nearly submerged in Buttermilk channel. It was towed to Staten Island, grounded at high water, and has subsequently been cut up for firewood. The piece found was about 30 feet long and 15 feet wide. It had no marks by which it could be identified.



APPENDIX H.

IMPROVEMENT OF RIVERS AND HARBORS IN NORTHEASTERN NEW JERSEY.

REPORT OF LIEUT. COL. C. W. RAYMOND, CORPS OF ENGINEERS,
OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1903,
WITH OTHER DOCUMENTS RELATING TO THE WORKS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Passaic River, New Jersey. | 5. Keyport Harbor, Matawan Creek, Rari- |
| 2. Arthur Kill, or Staten Island Sound,
New York and New Jersey, and
channel between Staten Island and
New Jersey. | tan, South, and Elizabeth rivers, and
Shoal Harbor and Compton Creek,
New Jersey. |
| 3. Woodbridge Creek, New Jersey. | 6. Shrewsbury River, New Jersey. |
| 4. Raritan Bay, New Jersey. | 7. Manasquan (Squan) River, New Jersey. |
| | 8. Removing sunken vessels or craft ob-
structing or endangering navigation. |

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., July 20, 1903.

GENERAL: I have the honor to transmit herewith the annual reports
upon the works of river and harbor improvement under my charge
for the fiscal year ending June 30, 1903.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

H 1.

IMPROVEMENT OF PASSAIC RIVER, NEW JERSEY.

Detailed descriptions of this river and of the projects for its improve-
ment are printed in the Annual Report of the Chief of Engineers for
1897, pages 1128 and 1129, in House Document No. 401, Fifty-sixth
Congress, first session, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

The river and harbor act approved June 13, 1902, under which the
new project for this improvement was adopted, appropriated \$75,000

for beginning the work, and authorized the making of a contract or contracts for the completion of the work, at a cost not to exceed \$221,000 exclusive of the amount appropriated, to be paid for as appropriations may from time to time be made by law. The sundry civil act approved March 3, 1903, appropriated \$100,000 for continuing the improvement as above authorized.

The following is a summary of the approved estimate of the cost of the improvement:

Dredging 1,214,000 cubic yards of material, at 15 cents.....	\$182, 100
Dredging 190,000 cubic yards of material, at 25 cents.....	47, 500
Diking 5,000 linear feet, at \$5.50 per foot.....	27, 500
Diking 4,000 linear feet, at \$3 per foot.....	12, 000
Engineering and contingencies, about 10 per cent.....	26, 900
Total	296, 000

In compliance with Department letter dated June 20, 1902, a project was submitted on September 20, 1902, for the expenditure of the appropriation of \$75,000 and of subsequent appropriations to be made under the continuing-contract system, as provided for by Congress. This project was approved on September 26, 1902, and the work of dredging required to complete the improvement was advertised on January 17 and proposals were opened on February 16, 1903. The lowest bid received for the dredging, estimated to cost \$229,600, was 27½ cents per cubic yard, which would make the total cost of the work \$386,100, or about 68 per cent in excess of the estimate.

With approval of the Department dated February 24, 1903, the proposals were rejected and the work was readvertised on March 23, 1903, with a view of obtaining bids falling within the limit of cost fixed by the act of Congress, and proposals were opened on April 22, 1903, when the lowest bid received was 28½ cents per cubic yard, at which price the cost of the dredging would be \$403,650, or about 75 per cent in excess of the cost authorized by law. These proposals were also rejected, by approval of the Department, as the lowest bid was in excess of the cost fixed by law and it was considered useless to readvertise the work this fiscal year.

The original estimate for the work was based upon surveys made in 1899 and upon the prices for labor, materials, and plant, which existed at that time; also upon the location of the public dumping ground at sea and upon the probable disposal of a part of the excavated material for the purpose of reclaiming marsh lands along the shores in the vicinity of the work. The favorable conditions for doing the work at the prices named do not now exist. The prices for labor, materials, and plant, have increased; the dumping ground has been moved 8 miles farther to seaward (the average tow is 30 miles), and the board of health of the city of Newark objects to having the dredged material placed upon the marshes or lands in the vicinity of the work, as contemplated in the estimate.

Upon Department letter dated April 20, 1903, I reported as follows:

1. Respectfully returned to the Chief of Engineers, U. S. Army.
2. Proposals for the improvement of the Passaic River under the provisions of the river and harbor act of June 13, 1902, have been twice received and they were in both cases so high that the work could not be done within the limit of cost authorized by law. Two appropriations have been made for this improvement—one of \$75,000 in the river and harbor act of June 13, 1902, with further provision for continuing the work; the other of \$100,000 in the sundry civil act of March 3, 1903, for continu-

ing the improvement. I do not think that either of these appropriations is available unless prices can be obtained which will permit of the execution of the work within the authorized limit.

3. There is no doubt that the interests of commerce demand that this work should be commenced as soon as possible, and I am very desirous of commencing it if the necessary expenditure is decided to be legal.

The following is a copy of a letter from the Comptroller to the Secretary of War relating to this subject:

WASHINGTON, May 14, 1903.

The honorable the SECRETARY OF WAR.

SIR: I have received by your authority the following letter from the Chief of Engineers, U. S. Army, dated May 1, 1903:

"1. I have the honor to state that the river and harbor act approved June 13, 1902, contains the following provision:

"Improving Passaic River, New Jersey, in accordance with the report submitted in House Document numbered four hundred and one, Fifty-sixth Congress, first session, from Staten Island Sound through Newark Bay and the said river to the Montclair and Greenwood Lake Railroad bridge, with a channel twelve feet deep to the Nairn Linoleum Works, and ten feet deep from that point to the said railroad bridge, seventy-five thousand dollars: *Provided*, That a contract or contracts may be entered into by the Secretary of War for such materials and work as may be necessary to complete the project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate two hundred and twenty-one thousand dollars, exclusive of the amount herein appropriated."

"2. The sundry civil act approved March 3, 1903, page 49, contains the following provision:

"Improving Passaic River, New Jersey: For continuing improvement from the Montclair and Greenwood Lake Railroad bridge to deep water in Staten Island Sound, one hundred thousand dollars."

"3. Bids have twice been asked for this work under specifications, copies of which are submitted herewith. The lowest bid received at the opening of the 16th of February, 1903, was 27½ cents; the lowest bid received at the opening of the 22d of April was 28½ cents; the lowest bid received at either opening was too high to permit the work to be completed in accordance with the project, which may be found in House Document No. 401, Fifty-sixth Congress, first session, above mentioned, page 16.

"4. In view of the above facts, I have the honor to request your opinion whether any of the money already appropriated by Congress, i. e., the \$75,000 appropriated by the river and harbor act of 1902, and the \$100,000 by the sundry civil act of 1903, can be employed in executing any portion of this work."

In a decision made at your request, August 2, 1898 (MS. Com. Dec., vol. 7, p. 159), in regard to similar appropriations for the War Department under the acts of June 3, 1896 (29 Stat., 207), and July 1, 1898 (30 Stat., 629), it was held that where authority had been given to the Secretary of War by Congress to contract for certain river and harbor improvements, limiting the cost thereof to a certain sum, and making partial appropriation for the work, and it having been ascertained that the contemplated work could not be completed within the limitation of cost fixed therefor, there was no authority to enter into a contract for a partial completion of the work, or to expend the money appropriated in doing a portion of the work. Some time thereafter, August 24, 1898, it was held in a review of this decision, made at your request (id., 363), that the partial appropriations could be used notwithstanding the work could not be completed within the limit of the act, but this conclusion was reached by considering facts developed in Congress affecting this particular case not before me when the prior decision was made, and in modifying my views to suit that particular case the correctness of the general rule of law therein stated was reaffirmed.

My decision of April 2, 1898, *supra*, was in agreement with an opinion of the Judge-Advocate-General of the Army given to you February 4, 1897, in the case of Oakland Harbor, California, in which there was a similar limitation of cost and similar partial appropriations. He therein held, basing his opinion on sections 3679, 3732, and 3733 of the Revised Statutes, that you had no authority to contract at all unless you could contract for the completion of the whole improvement; and in answer to the specific question whether the Secretary of War had authority to abandon a substantial part of the work referred to and contract for the remainder without further legislation, he said:

"I think he has not. As indicated above, I think he has no authority to contract at all unless he can contract for the completion of the whole improvement known as

the 'existing project,' for \$660,000 or less. It was evidently the intention of Congress to complete that 'project' provided it could be done for that amount, and each 'substantial part' of the project was as clearly included in that intention as any other part was. And a proper proportion of the \$660,000 was intended for each part. If the Secretary of War has no authority to contract for the whole unless he can do this within the limit of \$660,000, it is clear that he could not contract for a half of it unless he could do so for \$330,000. This would be as much in violation of the intent of Congress as the other would be."

Adopting this opinion, in which I concur, and following the rulings of this office, it must be held that none of the money already appropriated by Congress can be properly employed in executing any part of the work except under a contract limiting the cost of the entire work within the amount fixed by law.

I return herewith the papers forwarded by you.

Respectfully,

R. J. TRACEWELL,
Comptroller.

In view of the foregoing, and in accordance with Department indorsement of May 19, 1903, the estimate of the cost of the work has been revised for the consideration of the Department. The estimate for dredging is based on the lowest bid received for the work. No change in the estimate for diking or for engineering and contingencies is considered necessary. The estimated yearly cost of maintenance, now \$5,000, should be increased to \$10,000.

Estimate.

For dredging 1,404,000 cubic yards of material, at 27½ cents	\$386, 100
For diking 5,000 linear feet, at \$5.50 per foot	27, 500
For diking 4,000 linear feet, at \$3 per foot	12, 000
For engineering and contingencies	26, 900
Total	452, 500
For annual maintenance	10, 000

It appears from the above statement that under present conditions no money can be expended from existing appropriations for the improvement of this river under the adopted project unless the limit of cost for the complete execution of the work is increased by Congress from \$296,000 to \$452,500.

Complaints having been received that shoals had formed in the river at Newark, Rutherford, and Belleville, an examination was made in May and it was found that the dredged channel had shoaled from 2 to 4 feet. Under date of May 7 an allotment of \$10,000 from the appropriation for emergency work was requested for the removal of these shoals, and that sum was allotted by the Department on May 23, 1903.

Specifications were prepared for doing the work under an emergency contract by ten days' public notice. The work was advertised on May 28, and proposals opened June 8. The only bid received was 95 cents per cubic yard, which being excessive was rejected. The work was readvertised on June 9, and proposals were opened on June 25, the lowest bid being 78 cents per cubic yard. These bids were also excessive and were rejected. It is now proposed to do the work by hired plant if prices can be obtained that will admit of doing the required work with the funds available.

The available funds will be expended in dredging for continuance and maintenance of improvement.

Money statement.

July 1, 1902, balance unexpended	\$76,000.00
Amount appropriated by sundry civil act approved March 3, 1903.....	100,000.00
May 23, 1903, amount allotted from appropriation for emergencies in river and harbor works	10,000.00
November 28, 1902, deposited to credit of Treasurer of United States....	186,000.00
June 30, 1903, amount expended during fiscal year.....	1,706.45
July 1, 1903, balance unexpended.....	183,293.55
July 1, 1903, outstanding liabilities.....	1.06
July 1, 1903, balance available.....	183,292.49
{ Amount (estimated) required for completion of existing project.....	164,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$100,000.00
For maintenance of improvement.....	10,000.00
Submitted in compliance with requirements of act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	110,000.00

APPROPRIATIONS.

By act of—		By act of—	
June 10, 1872.....	\$25,000	August 11, 1888.....	\$35,000
March 3, 1873.....	25,000	September 19, 1890.....	45,100
June 23, 1874.....	20,000	July 13, 1892.....	45,000
March 3, 1875.....	20,000	August 18, 1894.....	15,000
August 10, 1876.....	10,000	June 3, 1896.....	15,000
June 18, 1878.....	10,000	March 3, 1899.....	15,000
March 3, 1879.....	2,000	June 6, 1900 (allotments)....	11,000
June 14, 1880.....	32,000	June 13, 1902.....	75,000
March 3, 1881.....	50,000	March 3, 1903.....	100,000
August 2, 1882.....	50,000		
July 5, 1884.....	28,000		
August 5, 1886.....	26,250	Total	654,350

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

Articles.	Tons.	Estimated value.
Building materials.....	775,445	\$4,935,576
Ores and metals.....	164,502	22,127,783
Fertilizer.....	68,824	800,000
Coal.....	173,227	1,167,079
Miscellaneous merchandise.....	826,952	98,136,092
To and from Hackensack River	485,362	4,868,258
Total.....	2,494,312	131,534,788

^a One thousand dollars returned to Treasury.

Statement showing number of vessels of all kinds, by months, passing through the Passaic River drawbridge of the New Jersey Central Railroad for the year ending December 31, 1902.

Month.	Vessels.	Month.	Vessels.	Month.	Vessels.
January	1,647	June.....	3,446	November.....	2,747
February	508	July	3,974	December	2,336
March	1,620	August	4,483	Total	32,172
April	1,791	September.....	3,975		
May	2,384	October.....	3,367		

The commerce is carried on in sail and steam vessels, canal boats, and barges drawing from 4½ to 15 feet.

At the United States custom-house, Newark, N. J., on the Passaic River, during the year 1902, the number of ships that entered and cleared was 168, and the tonnage was 39,392.

H 2.

IMPROVEMENT OF ARTHUR KILL OR STATEN ISLAND SOUND AND CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

(A) ARTHUR KILL OR STATEN ISLAND SOUND.

Detailed descriptions of this waterway and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1900, page 1525, in House Document No. 393, Fifty-sixth Congress, first session, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Work upon this improvement has not been commenced, pending the settlement of the question of location of channel, whether north or south of Shooters Island. In accordance with the provision of the river and harbor act of June 13, 1902, which adopted the project, and in pursuance with instructions from the Department, a survey was made and a map and estimate prepared, and a public hearing was held on November 25, 1902, report upon which was submitted on December 15, 1902; and a further report in this matter was submitted on March 27, 1903. In accordance with letter of the Chief of Engineers dated April 29, 1903, further surveys have been made and a map prepared, and it is proposed to hold a public hearing in this matter to consider proposed modification of harbor line on north shore of Staten Island on July 21, 1903. In compliance with instructions contained in Department letters dated June 20, 1902, and March 11, 1903, and in fifth indorsement, Office Chief of Engineers, May 19, 1903, project for expenditure of appropriation of \$100,000 made by river and harbor act of June 13, 1902, and of \$150,000 made by sundry civil act of March 3, 1903, respectively, was submitted on May 22, 1903, and was approved by the Secretary of War on June 10, 1903.

It is proposed to apply the available funds to dredging for the prosecution of the improvement in accordance with the adopted project.

Money statement.

July 1, 1902, balance unexpended	\$100,000.00
Amount appropriated by sundry civil act approved March 3, 1903.....	150,000.00
	<u>250,000.00</u>
June 30, 1903, amount expended during fiscal year	2,291.16
July 1, 1903, balance unexpended	<u>247,708.84</u>
{ Amount (estimated) required for completion of existing project	446,000.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of June 13, 1902	\$100,000
By act of March 3, 1903.....	150,000
Total	<u>250,000</u>

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

Articles.	Tons.
Coal	8,171,114
Ores and metals	264,025
Clay products	100,220
Chemicals and fertilizer.....	250,011
Oils	40,136
Machinery and manufactures.....	130,906
Lumber	10,000
General merchandise	5,550,667
Total	<u>14,517,079</u>

The above statement is based upon individual reports representing a large percentage of the total tonnage reported.

In the foreign trade 42 vessels entered and 48 cleared.

In the coastwise trade 86 vessels entered and 75 cleared.

The freight is carried in barges, canal boats, and steam and sailing vessels drawing from 5 to 23 feet of water.

The above commerce for 1902 was valued at \$205,707,009.

(B) CHANNEL BETWEEN STATEN ISLAND AND NEW JERSEY.

Detailed descriptions of this waterway and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, pages 1130 to 1132, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the appropriation of \$10,000 made by the river and harbor act approved June 13, 1902, and as contemplated by that act, and in accordance with project for its expenditure approved August 29, 1902,

which provides for expending \$5,000 in Lemon Creek and \$5,000 for maintenance work in the channel between Staten Island and New Jersey, dredging in Lemon Creek was advertised on October 11 and proposals were opened on November 10, 1902, and a contract dated December 2, 1902, was entered into with Duncan J. Currie for the removal of about 23,000 cubic yards of material, at 19 cents per yard, prism measurement. The work to be done consists in restoring and extending the channel. The project provides for a depth of 8 feet at mean high water and width of from 30 to 50 feet. Dredging under this contract was commenced on March 4, 1903 (with a pump dredge), and was continued at intervals, when the pump was in order, to May 13, at which time the pump was taken off and a bucket dredge employed, with which the work has been continued. At the close of the fiscal year the amount of material removed was 2,575 cubic yards, and the total length of channel restored to projected dimensions was 700 feet, of which 250 feet is below and 450 feet above the drawbridge. All the excavated material was placed upon the banks of the creek. The time limit for finishing the contract has been waived for a reasonable period, and it is proposed to complete the improvement under this contract.

It is proposed to apply the available funds and the additional appropriation recommended to maintaining the channel between Staten Island and New Jersey.

Money statement.

July 1, 1902, balance unexpended	\$11,850.88
June 30, 1903, amount expended during fiscal year	772.33
July 1, 1903, balance unexpended	11,078.55
July 1, 1903, outstanding liabilities	124.95
July 1, 1903, balance available	10,953.60
July 1, 1903, amount covered by uncompleted contracts	4,177.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement in addition to the balance unexpended July 1, 1903 20,000.00	
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
June 23, 1874	\$50,000	September 19, 1890	\$15,000
August 14, 1876	10,000	July 13, 1892	^a 5,000
June 18, 1878	15,000	July 13, 1892	15,000
June 14, 1880	29,000	August 18, 1894	^a 4,500
August 2, 1882	40,000	August 18, 1894	^b 6,000
July 5, 1884	10,000	June 3, 1896	^b 13,000
August 5, 1886	15,000	March 3, 1899	32,000
August 11, 1888	^a 10,000	June 13, 1902	^b 10,000
August 11, 1888	15,000		
September 19, 1890	^a 7,000	Total	301,500

^a Appropriation for improving Arthur Kill, New York and New Jersey—removal of Steep Point.

^b Includes \$5,000 for Lemon Creek.

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: Duncan J. Currie.
Date of contract: December 2, 1902.
Date of approval: December 27, 1902.
Date of commencement: January 20, 1903.
Date of completion: May 20, 1903; time of completion waived.
Dredging 23,000 cubic yards of material, more or less, in Lemon Creek, Staten Island, New York, at 19 cents per cubic yard, prism measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

This commerce is nearly identical with that passing through the Arthur Kill. Tonnage, 16,268,574; estimated value, \$280,516,505.

Lemon Creek.

[Extract from letter of Mr. Jos. C. Segulne.]

The principal industry at present is the preparation and sale of oysters. This business for the year 1902 reached the sum of about \$350,000, which was operated by a plant, consisting of boats, etc., of \$250,000. The above stream is very essential, as oysters planted in Princess Bay are prepared for shipment in Lemon Creek. This, heretofore, has been on a limited scale, owing to there not being sufficient water to permit the sloops, steamers, etc. (drawing from $3\frac{1}{2}$ to 6 feet and averaging from 4 to 40 tons capacity) to navigate at all tides. The improvement now in operation will very materially help and increase the above business. It will not only offer better facilities to the present plant, but will increase the tonnage, as there have been and are now building steamers and dredges which the above improvement has warranted. It will also increase the labor used in handling the above product, as oysters will be able to drink in the creek when heretofore same were taken to Keyport or Rahway River for this purpose.

There is also a coal and masons' material yard which does a business of \$25,000 per annum, using schooners and canal boats of a capacity of from 80 to 200 tons.

There is a boat-building concern doing a business of \$8,000 per year, and the Standard Oil Company have located an agency on said creek to supply boats with gasoline and other oils. This business will very materially increase, owing to the navigation offered by the improvement.

H 3.

IMPROVEMENT OF WOODBRIDGE CREEK, NEW JERSEY.

Detailed descriptions of this creek and of the projects for its improvement are printed in House Document No. 282, Fifty-sixth Congress, first session, in Annual Report of the Chief of Engineers for 1900, page 1552, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the appropriation of \$10,000 made by the river and harbor act approved June 13, 1902, and in accordance with project for its expenditure, approved July 23, 1902, dredging was advertised on October 11, and proposals were opened on November 10, 1902, and a contract, dated November 24, 1902, was entered into with the Newburgh Dredging Company for the removal of about 45,000 cubic yards of material, at 20 cents per cubic yard, scow measurement. Work

under this contract was commenced on December 3, 1902, and completed March 31, 1903. Operations were suspended between January 12 and February 26, 1903, on account of cold weather and ice. The total amount of material removed under the contract was 45,066 cubic yards, and the total length of channel dredged to projected dimensions of 50 feet bottom width and 8 feet depth at mean low water was 2,850 feet. This completed length extends from the Salamander dock to the Clay docks. In addition to this work, two bars between the Clay docks and Addick's works were removed, practically completing the improvement from the Salamander dock to the Addick's works, a length of 4,600 feet. The remainder of the river from Addick's works to the mouth, a length of 5,000 feet, has a depth of from 6 to 8 feet at mean low water, with narrow widths. The work mentioned above, the first done under the present project, has been limited to the upper section of the river, in which the depths were from 1 to 2 feet at mean low water and where navigation had been nearly suspended on account of bars which had formed in the channel dredged under the previous project. The material removed from the creek was pumped ashore upon lowlands of Valentine Brothers, located in the upper part of the channel, thus making a useful addition to their property.

It is proposed to apply the additional appropriation recommended to the completion of the project.

Money statement.

July 1, 1902, balance unexpended	\$10,000.00
June 30, 1903, amount expended during fiscal year	9,948.95
July 1, 1903, balance unexpended	51.05
July 1, 1903, outstanding liabilities	22.70
July 1, 1903, balance available	28.35
(Amount (estimated) required for completion of existing project	25,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$25,000.00
For maintenance of improvement	3,000.00
	28,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For previous project.

By act of—	
March 3, 1879	\$4,000
June 14, 1880	5,000
March 3, 1881	5,000
August 2, 1882	5,000
Total	19,000

For present project.

By act of—	
June 13, 1902	10,000
Total for both projects	29,000

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: The Newburgh Dredging Company.
 Date of contract: November 24, 1902.
 Date of approval: December 19, 1902.
 Date of commencement: January 13, 1903.
 Date of completion: April 13, 1903.
 Dredging 45,000 cubic yards of material, more or less, at 20 cents per cubic yard, scow measurement.
 Contract was completed March 31, 1903.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

Articles.	Tons.	Estimated value.
Received:		
Coal and lumber.....	24, 129	\$88, 202
Clay.....	15, 000	37, 500
Sawdust.....	3, 000	3, 000
Tin scrap.....	4, 360	52, 300
Steel scrap.....	2, 675	40, 125
Shipped:		
Fire, building, and hollow brick, tile, etc.....	77, 371	438, 594
Clay.....	6, 942	20, 705
Tin powder.....	900	450, 000
Total.....	134, 377	1, 130, 426

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
Steamers.....	67	.....	<i>Feet.</i> 7 to 9	150 to 500
Sail vessels.....	51	400	5 to 11½	45 to 300
Barges, etc.....	102	197	6 to 11	50 to 400
Total.....	220	597		

H 4.

IMPROVEMENT OF RARITAN BAY, NEW JERSEY.

Detailed descriptions of this bay and of the projects for its improvement as printed in the Annual Report of the Chief of Engineers for 1897, pages 1142 and 1143, and in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the appropriation of \$45,000 made by the river and harbor act approved June 13, 1902, and in accordance with project for its expenditure approved August 26, 1902, dredging for completion and maintenance of project was advertised October 11, and proposals were opened November 10, 1902, and a contract dated November 24, 1902, was entered into with the R. G. Packard Company for the removal of about 250,000 cubic yards of material at the rate of 16 cents per cubic yard, scow measurement. Work under this contract was commenced

on April 29, 1903, and has been in progress since that date. At the close of the fiscal year 95,544 cubic yards of material, mud and sand, had been removed from the "South Amboy channel" between the mouth of Raritan River and tail of Great Beds. The area dredged over and restored to project depth of 21 feet at mean low water is 6,400 feet in length and from 50 to 300 feet in width. The dredged material was dumped at sea.

A report upon a preliminary examination made in compliance with section 14 of the river and harbor act of June 13, 1902, and with Department letter dated June 23, 1902, was submitted on October 14, 1902, and in compliance with Department letter of October 22, 1902, an estimate of the cost of obtaining a depth of 22 feet of water, 400 feet wide at mean low water, from South Amboy to tail of Great Beds, was submitted on January 21, 1903.

The channels to be dredged under the approved project for this improvement have been practically completed once, but owing to continual shoaling they are never in a completed condition, so that dredging for maintenance has always been necessary.

It is proposed to apply the additional appropriation recommended to restoration of channels to full projected dimensions.

Money statement.

July 1, 1902, balance unexpended	\$45,930.00
June 30, 1903, amount expended during fiscal year	10,384.20
July 1, 1903, balance unexpended	35,545.80
July 1, 1903, outstanding liabilities	7,785.21
July 1, 1903, balance available	27,760.59
July 1, 1903, amount covered by uncompleted contracts	24,712.96
(Amount (estimated) required for completion of existing project	164,630.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$50,000.00
For maintenance of improvement.....	20,000.00
	70,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1881	\$50,000	August 18, 1894.....	\$40,000
August 2, 1882	50,000	June 3, 1896	75,000
July 5, 1884	20,000	March 3, 1899	65,000
August 5, 1886	37,500	June 13, 1902.....	45,000
August 11, 1888.....	25,000		
September 19, 1890	40,000	Total	487,500
July 13, 1892	40,000		

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: R. G. Packard Company.

Date of contract: November 24, 1902.

Date of approval: December 19, 1902.

Date of commencement: January 13, 1903.

Date of completion: August 20, 1903.

Dredging 250,000 cubic yards of material, more or less, at 16 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

Articles.	Tons.
Received:	
Ores and metals.....	47,350
Clay products.....	5,778
Chemicals and fertilizer.....	31,808
Oils.....	3,115
Machinery and manufactures.....	14,821
Lumber.....	10,526
General merchandise.....	37,979
Shipped:	
Coal.....	5,214,579
Ores and metals.....	18,589
Clay products.....	17,917
Chemicals and fertilizer.....	20,825
Oils.....	5,334
Machinery and manufactures.....	12,738
General merchandise.....	11,768
Total.....	5,453,122

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
		<i>Feet.</i>	
Steamers.....	10,020	7 to 23	50 to 1,000
Sail vessels.....	15,050	3 to 23	3 to 800
Barges, etc.....	44,309	7 to 23	100 to 2,000
Total.....	69,379		

The value of the above commerce in 1902 was estimated at \$56,712,469.

H 5.

IMPROVEMENT OF KEYPORT HARBOR, MATAWAN CREEK, RARITAN, SOUTH, AND ELIZABETH RIVERS, AND SHOAL HARBOR AND COMPTON CREEK, NEW JERSEY.

(A) KEYPORT HARBOR.

Detailed descriptions of this harbor and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, pages 1147 to 1149, and in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the allotment of \$5,000 from the consolidated appropriation of \$43,000 made by the river and harbor act approved June 13, 1902, for the improvement of "Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey," and in accordance with project for its expenditure, approved September 10, 1902, dredging was advertised October 14 and proposals were opened November 13, 1902, and a contract dated December 16, 1902, was entered into with The International Contracting Company for the removal of about 30,600 cubic yards of material from

Keyport Harbor and Matawan Creek at 23½ cents per cubic yard, scow measurement. It was estimated, in accordance with the division of the allotments, that five-eighths of the yardage would be removed from Keyport Harbor and three-eighths from Matawan Creek.

Dredging in Keyport Harbor, for maintenance, under this contract was commenced on March 19 and completed on April 21, 1903. The total amount of material removed was 18,700 cubic yards. The work accomplished was the redredging of the channel for a length of 2,300 feet, extending out from the steamboat dock at Keyport. The depth made was from 8 to 9 feet at mean low water, and width of 70 feet. The material removed—mud—was taken away in scows and dumped either at sea or in the fill at Governors Island. At the close of work this season the dimensions of the improved channel were as mentioned above.

It is proposed to apply the additional appropriation recommended to the completion and maintenance of the improvement in accordance with the adopted project.

Money statement.

August 1, 1902, amount allotted	\$5,000.00
June 30, 1903, amount expended during fiscal year	4,906.45
July 1, 1903, balance unexpended	93.55
July 1, 1903, outstanding liabilities	12.45
July 1, 1903, balance available	81.10
Amount (estimated) required for completion of existing project	9,975.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$9,975.00
For maintenance of improvement	5,000.00
	14,975.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
August 2, 1882	\$30,475	March 3, 1899	\$2,500
July 13, 1892	5,000	June 13, 1902 (allotment) ..	5,000
August 18, 1894	5,000		
June 3, 1896	2,500	Total	50,475

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: The International Contracting Company.
Date of contract: December 16, 1902.
Date of approval: January 8, 1903.
Date of commencement: February 2, 1903.
Date of completion: April 20, 1903; time of completion waived.
Dredging 30,668 cubic yards of material (including 11,968 cubic yards in Matawan Creek), at 23½ cents per cubic yard, scow measurement.
Contract completed May 30, 1903.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

[Statement by James H. Ward, superintendent Staten Island Sound Transportation Company.]

Articles.	Tons.	Estimated value.
Received:		
General merchandise	12, 000	\$480, 000
Manure and fertilizer	7, 000	28, 000
Coal and lumber	6, 000	Unknown.
Shipped:		
Farm produce	25, 000	1, 000, 000
Fish and shellfish	12, 000	120, 000
Total	62, 000	1, 628, 000

Vessels engaged in above commerce.

Class.	Number.	Number of trips.	Draft when loaded.	Tonnage.
Steamers	3	a 1,080	<i>Feet.</i> 8 to 9	300 to 500
Sail vessels	60	Unknown.	4 to 12	50 to 300
Barges, etc	125	Unknown.	.....	75 to 350
Total	188	1,080		

a Approximate.

The Staten Island Sound Transportation Company have added a line from Keyport. To the above should be added the commerce of Matawan Creek, New Jersey, as it passes in and out through Keyport Harbor.

(B) MATAWAN CREEK.

Detailed descriptions of this creek and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1145, and in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the allotment of \$3,000 from the consolidated appropriation of \$43,000 made by the river and harbor act approved June 13, 1902, for the improvement of "Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth Rivers, and Shoal Harbor and Compton Creek, New Jersey," and in accordance with project for its expenditure approved September 10, 1902, dredging was advertised October 14 and proposals were opened November 13, 1902, and a contract dated December 16, 1902, was entered into with the International Contracting Company for the removal of about 30,600 cubic yards of material from Keyport Harbor and Matawan Creek, at 23½ cents per cubic yard, scow measurement, of which, in accordance with the division of the allotments, about three-eighths of the yardage was to be removed from Matawan Creek. Work was commenced on April 8, and the contract was completed on May 30, 1903.

The total amount of material removed from Matawan Creek was 11,968 cubic yards. The work accomplished, which was all for maintenance, was redredging the channel in the vicinity of and below the

steamboat wharf for a length of 1,790 feet, width of from 30 to 60 feet, and depth of 4 feet at mean low water. The material removed, which was mud and sand, was placed upon the banks of the creek. The available channel depth in Matawan Creek is now about 4 feet at mean low water; the width is from 30 to 60 feet. It is proposed to apply the additional appropriation recommended to the completion and maintenance of the improvement in accordance with the adopted project.

Money statement.

August 1, 1902, amount allotted	\$3,000.00
June 30, 1903, amount expended during fiscal year	3,000.00
	<u>12,120.00</u>
(Amount (estimated) required for completion of existing project.....)	12,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$12,120.00
For maintenance of improvement.....	3,000.00
	<u>15,120.00</u>
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1881	\$15,000	June 3, 1896	\$3,000
August 2, 1882	6,000	March 3, 1899	3,000
September 19, 1890	2,500	June 13, 1902 (allotment) ..	3,000
July 13, 1892	9,620		
August 18, 1894	3,000	Total	<u>45,120</u>

ABSTRACT OF CONTRACT IN FORCE.

Name of contractor: The International Contracting Company.
Date of contract: December 16, 1902.
Date of approval: January 8, 1903.
Date of commencement: February 2, 1903.
Date of completion: April 20, 1903; time of completion waived.
Dredging 30,668 cubic yards of material (including 18,700 cubic yards in Keyport Harbor), at 23½ cents per cubic yard, scow measurement.
Contract completed May 30, 1903.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

[Statement by Jas. H. Ward, superintendent Staten Island Sound Transportation Company.]

Articles.	Tons.	Estimated value.
Received:		
General merchandise	10,000	\$400,000
Fertilizer	10,000	40,000
Shells and lime	7,500	Unknown.
Shipped:		
Farm produce	20,000	800,000
Brick	10,000	25,000
Soil	4,000	Unknown.
Total	<u>61,500</u>	<u>1,265,000</u>

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
Steamers	265	<i>Feet.</i> 5 to 8½	1 to 75
Sail vessels	Unknown.	.....	.....
Barges, etc	86	5 to 8	50 to 300
Total	351		

(C) RARITAN RIVER.

Detailed descriptions of this river and of the projects for its improvement are printed in the Annual Reports of the Chief of Engineers for 1897, pages 1136 to 1139; for 1900, page 1505, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the allotment of \$20,000 from the consolidated appropriation of \$43,000 made by the river and harbor act approved June 13, 1902, for the improvement of "Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey," and in accordance with project for its expenditure approved September 10, 1902, dredging was advertised October 14, and proposals were opened November 13, 1902. The lowest bid received was from Mr. E. R. Seward, of New York, who offered to do the work at the rate of 30 cents per cubic yard, but who failed to enter into contract with good and approved security. The work was readvertised on February 2, and bids were opened on March 4, 1903, and a contract dated March 24, 1903, was entered into with Messrs. Rogers & O'Brien for the removal of about 72,000 cubic yards of material at 25 cents per cubic yard, scow measurement. Dredging, for maintenance, was commenced on June 6, and has been in operation since that date. At the close of the fiscal year 2,408 cubic yards of material, mud and sand, had been removed under this contract, of which 1,930 yards were removed from the Middle Ground in the vicinity of "Dike 2," and the remainder, 478 yards, were removed from the branch channel leading to Pfeiffer's, formerly Acken's, dock at the mouth of Red Root Creek. The latter work was authorized by the Chief of Engineers June 22, 1903, to be done under the pending contract.

The work thus far accomplished under the contract consists in making one cut 860 feet long at the Middle Ground, with depth of 12 feet, and one cut 300 feet long, with depth of 6 feet, at the mouth of Red Root Creek.

Details in reference to progress made upon this improvement and estimates for its completion may be found in the Annual Report of the Chief of Engineers for 1900, pages 180 and 1505.

To maintain the work already done, an annual appropriation of \$10,000 is considered necessary. The additional appropriation recommended will be applied to widening the channel between Whitehead's dock and New Brunswick, and to maintenance work.

Money statement.

July 1, 1902, balance unexpended.....	\$3,355.00
August 1, 1902, amount allotted.....	20,000.00
June 30, 1903, amount expended during fiscal year.....	23,355.00
	1,105.97
July 1, 1903, balance unexpended.....	22,249.03
July 1, 1903, outstanding liabilities.....	617.85
July 1, 1903, balance available.....	21,631.18
July 1, 1903, amount covered by uncompleted contracts.....	17,398.00
{ Amount (estimated) required for completion of existing project.....	383,750.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$50,000.00
For maintenance of improvement.....	10,000.00
	60,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
June 18, 1878.....	\$200,000	September 19, 1890.....	\$50,000
March 3, 1879.....	60,000	July 13, 1892.....	40,000
June 14, 1880.....	100,000	August 18, 1894.....	20,000
March 3, 1881.....	25,000	June 3, 1896.....	20,000
August 2, 1882.....	25,000	March 3, 1899.....	20,000
July 5, 1884.....	35,000	June 13, 1902 (allotment) ..	20,000
August 5, 1886.....	26,250		
August 11, 1888.....	50,000	Total.....	691,250

ABSTRACT OF CONTRACT IN FORCE.

Names of contractors: Rogers & O'Brien.
Date of contract: March 24, 1903.
Date of approval: May 7, 1903.
Date of commencement: June 1, 1903.
Date of completion: December 1, 1903.
Dredging 72,000 cubic yards of material, more or less, at 25 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

Articles.	Tons.
Coal.....	113,948
Clay, ores, sand, etc.....	399,396
Lumber.....	65,592
Manufactures.....	536,819
Miscellaneous.....	113,037
Total.....	1,228,791

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
		<i>Fath.</i>	
Steamers	2, 263	5 to 11	50 to 500
Sail vessels	5, 370	3 to 17	10 to 750
Barges, etc	10, 790	5 to 12	50 to 520
Total	18, 423		

The value of commerce in 1902 was \$15,052,690.

(D) SOUTH RIVER.

Detailed description of this river and of the projects for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1139, and in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the allotment of \$5,000 from the consolidated appropriation of \$43,000 made by the river and harbor act approved June 13, 1902, for the improvement of "Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey," and in accordance with project for its expenditure approved September 11, 1902, dredging was advertised October 14 and proposals were opened November 13, 1902. The lowest bids received for doing the work—35 cents per cubic yard—were considered excessive and their rejection was recommended and authorized. The work was readvertised on February 2, 1903, and proposals were opened on March 4, and a contract dated March 24, 1903, was entered into with Messrs. Rogers & O'Brien for the removal of about 18,000 cubic yards of material, at 25 cents per cubic yard, scow measurement. Dredging under the contract has not been commenced, as it includes the work to be done in Raritan River, which, as provided for in the contract, has been commenced first. Details as to the progress made in carrying out this project may be found in the Annual Reports of the Chief of Engineers for 1900, page 181, and for 1901, page 1237.

The additional appropriation recommended will be applied to continuing the improvement and maintenance work.

Money statement.

August 1, 1902, amount allotted	\$5, 000. 00
June 30, 1903, amount expended during fiscal year	36. 95
July 1, 1903, balance unexpended	4, 963. 05
July 1, 1903, amount covered by uncompleted contracts.....	4, 500. 00
(Amount (estimated) required for completion of existing project	98, 975. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$50, 000. 00
For maintenance of improvement.....	5, 000. 00
	55, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For previous project.

By act of—		
March 3, 1871.....	\$15,000	
March 3, 1873.....	5,000	
		<u>\$20,000</u>

For present project.

By act of—		
June 14, 1880.....	40,000	
March 3, 1881.....	6,000	
August 2, 1882.....	10,000	
August 5, 1886.....	5,000	
August 11, 1888.....	5,000	
September 19, 1890.....	5,000	
July 13, 1892.....	7,000	
August 18, 1894.....	5,000	
June 3, 1896.....	5,000	
March 3, 1899.....	5,000	
June 13, 1902 (allotment).....	5,000	
		<u>98,000</u>
Total for both projects.....		<u>118,000</u>

ABSTRACT OF CONTRACT IN FORCE.

Names of contractors: Rogers & O'Brien.

Date of contract: March 24, 1903.

Date of approval: May 7, 1903.

Date of commencement: December 1, 1903.

Date of completion: March 1, 1904.

Dredging 18,000 cubic yards of material, more or less, at 25 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

Articles.	Tons.	Estimated value.
Received:		
Coal.....	10,200	\$49,700
Clay, sand, etc.....	156,850	386,250
Manufactures.....	214,196	648,435
Miscellaneous.....	6,000	31,250
Total.....	387,246	1,115,635

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
		<i>Feet.</i>	
Steamers.....	954	6 to 9	150 to 300
Sail vessels.....	1,210	5 to 13	35 to 600
Barges, etc.....	2,142	5 to 9	30 to 700
Total.....	4,306		

(E) ELIZABETH RIVER.

Detailed descriptions of this river and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1134, and in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR

Under the allotment of \$2,000 from the consolidated appropriation of \$43,000 made by the river and harbor act approved June 13, 1902, for the improvement of "Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey," and in accordance with project for its expenditure approved September 10, 1902, dredging was advertised October 14, 1902, and proposals were opened November 13, 1902, and a contract dated December 16, 1902, was entered into with Kirk, Driscoll & Co. for the removal of about 5,100 cubic yards of material, at 35 cents per cubic yard, scow measurement. Work under the contract has not yet been commenced, as the contractors took the dredging at Shoal Harbor and Compton Creek under the same advertisement, which was to be completed first.

The work to be done will be applied to maintenance of upper part of channel.

The available funds, and additional appropriation recommended, will be applied to maintenance and completion of improvement in accordance with the adopted project.

Money statement.

August 1, 1902, amount allotted	\$2,000.00
June 30, 1903, amount expended during fiscal year	6.50
July 1, 1903, balance unexpended	1,993.50
July 1, 1903, amount covered by uncompleted contracts.....	1,800.00
(Amount (estimated) required for completion of existing project	16,160.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$16,160.00
For maintenance of improvement.....	5,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	21,160.00

APPROPRIATIONS.

By act of—		By act of—	
March 3, 1879	\$7,500	August 18, 1894.....	\$3,000
June 14, 1880.....	7,500	June 3, 1896.....	3,160
March 3, 1881.....	4,000	June 13, 1902 (allotment)...	2,000
August 2, 1882.....	8,000		
September 19, 1890.....	5,000	Total	45,160
July 13, 1892.....	5,000		

ABSTRACT OF CONTRACT IN FORCE.

Names of contractors: Kirk, Driscoll & Co.
 Date of contract: December 16, 1902.
 Date of approval: January 15, 1903.
 Date of commencement: February 8, 1903.
 Date of completion: May 15, 1903. Time of completion waived.
 Dredging 5,100 cubic yards of material, more or less, at 35 cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

[Statement by merchants located on river.]

Articles.	Tons.	Estimated value.
Received:		
Tar, pitch, and rags.....	6,670	\$45,357
Chemicals.....	1,087	9,390
Coal.....	10,400	37,400
Lumber.....	4,000	41,000
Clams.....	400	9,000
Brick, stone, and sand.....	16,150	94,320
Shipped:		
Roofing, building papers, etc.....	833	24,990
Lumber.....	500	6,000
Gas coke.....	130	420
Chemicals.....	80	10,600
Total.....	40,250	278,477

Vessels engaged in above commerce.

Class.	Number of vessels.	Number of trips.	Draft when loaded.	Tonnage.
			<i>Feet.</i>	
Steamers.....	2	53	6 to 13	43 to 300
Sail vessels.....	43	249	4 to 9	25 to 235
Barges, etc.....	59	198	4 to 7	75 to 300
Total.....	104	500		

(F) SHOAL HARBOR AND COMPTON CREEK.

Detailed descriptions of this locality and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1897, page 1150, and in the current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

Under the allotment of \$8,000 from the consolidated appropriation of \$43,000 made by the river and harbor act approved June 13, 1902, for the improvement of "Keyport Harbor, Matawan Creek, Raritan, South, and Elizabeth rivers, and Shoal Harbor and Compton Creek, New Jersey," and in accordance with project for its expenditure approved September 10, 1902, dredging was advertised on October 14, 1902, and proposals were opened on November 13, 1902, and a contract dated December 16, 1902, was entered into with Kirk, Driscoll & Co.

for the removal of about 24,000 cubic yards of material, at the rate of 30 cents per cubic yard, scow measurement. Dredging for maintenance, under this contract, was commenced on January 28, 1903, and the contract was completed on June 12, 1903. The total amount of material, sand, mud, and clay removed was 24,020 cubic yards. The work accomplished was the dredging of the channel in Shoal Harbor and mouth of Compton Creek to depth of from 4 to 5 feet at mean low water for a length of 3,000 feet. The widths made were 50 feet for a length of 2,200 feet in harbor and mouth of creek and 75 feet for a length of 800 feet near the wharves. Most of the excavated material was pumped on the land in the vicinity of the steamboat wharf, making valuable additions to property which was formerly low and marsh land. The present condition of this improvement is as stated above.

The additional appropriation recommended will be applied to completion and maintenance of the project.

Money statement.

August 1, 1902, amount allotted	\$8,000.00
June 30, 1903, amount expended during fiscal year	7,006.86
July 1, 1903, balance unexpended	993.14
July 1, 1903, outstanding liabilities	733.86
July 1, 1903, balance available	259.28
Amount (estimated) required for completion of existing project	47,130.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$25,000.00
For maintenance of improvement	5,000.00
	30,000.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act of—		By act of—	
September 19, 1890	\$5,000	March 3, 1899	\$8,000
July 13, 1892	3,000	June 13, 1902 (allotment)...	8,000
August 18, 1894	3,000		
June 3, 1896	5,000	Total	32,000

ABSTRACT OF CONTRACT IN FORCE.

Names of contractors: Kirk, Driscoll & Co.
Date of contract: December 16, 1902.
Date of approval: January 15, 1903.
Date of commencement: February 8, 1903.
Date of completion: April 15, 1903. Time of completion waived.
Dredging 24,000 cubic yards of material, more or less, at 30 cents per cubic yard, scow measurement.
Work completed June 12, 1903.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

[Statement by Mr. Vernon S. Vail, Port Monmouth, N. J.]

Articles.	Tons.	Estimated value.
Received:		
Coal.....	3,000	\$18,000
Fertilizer.....	12,000	18,000
Fish.....	1,500	4,400
Shellfish.....	6,000	135,000
Miscellaneous.....	4,000	128,000
Shipped:		
Farm produce.....	16,000	512,000
Shellfish.....	6,000	135,000
Fertilizer.....	240	10,560
Fish oil.....	50	3,300
Total.....	48,790	964,260

Vessels engaged in above commerce. .

Class.	Number of trips.	Draft when loaded.	Tonnage.
		<i>Fect.</i>	
Steamers.....	3	4 to 6	60 to 600
Sail vessels.....	50	2 to 5½	15 to 40
Sloops.....	25	2 to 6	10 to 45
Gasoline boats.....	80	1½ to 5	1 to 30
Total.....	158		

Two new lines of transportation were established in 1902, viz, Steamer *Empress* and steamer *Cortis*.

H 6.

IMPROVEMENT OF SHREWSBURY RIVER, NEW JERSEY.

Detailed descriptions of this river and of the projects for its improvement are printed in the Annual Reports of the Chief of Engineers for 1897, pages 1152 to 1155; for 1900, page 185, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

The river and harbor act approved June 13, 1902, contained an appropriation of \$75,000 for the completion of this improvement, and Department letter dated June 20, 1902, directed that a project for the expenditure of this appropriation be submitted.

Before a general project could be prepared it became necessary to recommend the approval of a preliminary project for the expenditure of \$5,000 for emergency work required to keep open the west channel in the main stem in order to relieve navigation for the season of 1902, and such a project was submitted on June 28, which was approved on July 7, 1902, and work under same was commenced on August 6 and completed on August 30, 1902. This work together with that done previously by the Patten and Merchants' Steamboat lines sufficed to make the river navigable during the season of 1902. A general proj-

ect for the expenditure of the balance of the appropriation, based upon examinations made in November, 1902, was submitted on January 21, 1903. This project was returned on February 11, 1903, with inquiry as to whether any of the work recommended should be carried out before completion of the new survey to be made by Maj. W. L. Marshall, to whom was assigned the duty of making the preliminary examination of Shrewsbury River authorized by act of June 13, 1902. The project was returned to the Department on February 14 with indorsement stating that at least 50,000 cubic yards of material at a cost of about \$15,000 should be removed from the shoals as soon as possible in order to provide a navigable channel for the season of navigation of 1903, soon to open. The proposed expenditure was approved on February 17, 1903, and under date of June 24, 1903, an extension to this expenditure of \$3,000 was authorized by the Chief of Engineers.

The dredging of the fiscal year was done by emergency contracts under ten-day public notices, as authorized July 7, 1902, and February 25, 1903. Contracts for the work were entered into with The Newburg Dredging Company, the lowest bidder, under public notices dated July 14, 1902, and March 2, 1903. The contract for the season of 1902, dated August 2, 1902, provided for the removal of about 16,000 cubic yards of material at 28 cents per cubic yard, scow measurement, and the contract for the season of 1903, dated March 18, 1903, provides for the removal of about 50,000 cubic yards of material at 26½ cents per cubic yard, scow measurement.

Under the contract of 1902, 16,010 cubic yards of sand were removed and deposited by pump inside of dike "B." The work done consisted in widening the entrance to the channel in the main stem 100 feet, to provide an easy curve by cutting off the point of shoal on the west side near the dike, and in making two cuts about 7 feet deep at mean low water, each 25 feet wide and about 2,600 feet long, through the shoal in the west branch of the main stem. This work, together with work done by the Patten Steamboat Company in May and June, provided a navigable channel from deep water near the dike to deep water west of Island Beach.

Under the contract of 1903 dredging was commenced on April 9 and continued up to the close of the fiscal year, at which time the proposed work was nearly completed. At the close of the fiscal year the following work had been accomplished. The amount of material, sand, removed, which was pumped ashore from scows on the marshes behind dike "B," main stem, dike "C," North Branch, and dike "K," at Seabright, was 52,262 cubic yards, divided as follows:

	Cubic yards.
From main stem	22, 545
From Reeves channel	10, 656
From Upper Rocky Point.....	9, 668
From Seabright bridge.....	1, 710
From Seabright bend.....	7, 683
Total	52, 262

LOCATION OF DREDGING.

In the main stem, 160 feet wide for a length of 700 feet, 75 feet wide for a length of from 1,720 to 1,820 feet, and 50 feet wide for a length of 75 feet, which work has provided a channel through the main

stem from 100 to 160 feet in width; at Reeves channel, 100 feet in width for a length of 725 feet; at Upper Rocky Point, channels from 50 to 100 feet in width and 1,125 feet in length, and at Seabright 50 to 100 feet in width and 250 feet in length. All the dredging was carried to a depth of 7 feet at mean low water.

In compliance with Department letter dated January 22, 1903, \$5,000 of the appropriation of June 13, 1902, was transferred to Maj. W. L. Marshall on March 18, 1903, to be applied to new survey of river to be made under his direction.

It is proposed to apply the available balance and the appropriation recommended to the completion and maintenance of improvement in accordance with the project.

Money statement.

July 1, 1902, balance unexpended	\$75,000.00
March 18, 1903, transferred to Maj. W. L. Marshall.....	\$5,000.00
June 30, 1903, amount expended during fiscal year	14,752.35
	<u>19,752.35</u>
July 1, 1903, balance unexpended	55,247.65
July 1, 1903, outstanding liabilities	6,304.90
	<u>48,942.75</u>
July 1, 1903, balance available	48,942.75
July 1, 1903, amount covered by uncompleted contracts.....	2,050.56
	<u>2,050.56</u>
(Amount (estimated) required for completion of existing project	20,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$20,000.00
For maintenance of improvement	10,000.00
	<u>30,000.00</u>
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

For previous project.

By act of—	
August 30, 1852	\$1,500
March 3, 1871	14,000
March 3, 1873	5,000
	<u>\$20,500</u>

For present project.

By act of—	
June 18, 1878	18,000
March 3, 1879	10,000
June 14, 1880	30,000
March 3, 1881	86,000
August 2, 1882	30,000
August 5, 1886	10,000
August 11, 1888	10,000
September 19, 1890	10,000
July 13, 1892	10,000
August 18, 1894	5,000
June 3, 1896	15,000
March 3, 1899	10,000
June 6, 1900 (allotment)	10,000
June 13, 1902	75,000
	<u>329,000</u>

Total for both projects..... 349,500

ABSTRACTS OF CONTRACTS IN FORCE.

Name of contractor: The Newburgh Dredging Company.

Date of contract: August 2, 1902.

Date of commencement: August 12, 1902.

Date of completion: September 21, 1902.

Dredging 16,000 cubic yards of material, at 28 cents per cubic yard, scow measurement.

Contract was completed on August 30, 1902.

Name of contractor: The Newburgh Dredging Company.

Date of contract: March 18, 1903.

Date of commencement: April 1, 1903.

Date of completion: August 31, 1903.

Dredging 50,000 cubic yards of material, more or less, at 26½ cents per cubic yard, scow measurement.

COMMERCIAL STATISTICS.

Freight received and shipped by water, 1902.

[Statement by Capt. Chas. Throckmorton, of the Red Bank Steamboat Line, and T. G. and W. R. Patten, of the Patten Line.]

Articles.	Tons.	Estimated value.
Received:		
Coal.....	30,000	\$150,000
Lumber.....	1,000	30,000
Building materials.....	15,000	750,000
Miscellaneous.....	400,000	250,000
Shipped:		
Farm produce.....	200,000	4,000,000
Fish and shellfish.....	10,000	400,000
Miscellaneous.....	1,000	100,000
Total.....	657,000	5,680,000

Vessels engaged in above commerce.

Class.	Number of trips.	Draft when loaded.	Tonnage.
Steamers.....	376	<i>Feet.</i> 4½ to 5½	300 to 500
Sail vessels.....	180	3½ to 5	25 to 40
Total.....	556		

Number of passengers carried by the Patten Line in 1902 was 264,635

H 7.

IMPROVEMENT OF MANASQUAN (SQUAN) RIVER, NEW JERSEY.

Detailed descriptions of this river and of the project for its improvement are printed in the Annual Report of the Chief of Engineers for 1898, page 1070, and in current summary.

OPERATIONS DURING THE PAST FISCAL YEAR.

No work was done during the year, as the funds on hand would not permit of the construction of a sufficient length of the proposed south dike to result in any benefit to navigation.

The balance available will be retained until another appropriation has been made or until the available funds are sufficient to undertake the necessary work.

Money statement.

July 1, 1902, balance unexpended	\$5,925.00
July 1, 1903, balance unexpended	5,925.00
{ Amount (estimated) required for completion of existing project.....	14,375.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	14,375.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act of—	
March 3, 1879.....	\$12,000
June 14, 1880.....	20,000
August 2, 1882.....	7,000
September 19, 1890.....	2,000
March 3, 1899.....	5,000
Total	46,000

COMMERCIAL STATISTICS.

The commerce of this river amounts practically to nothing, owing to obstructions at the inlet. The river is largely used by pleasure craft during the summer season.

H 8.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

Wreck of barge Eldorado in Passaic River, New Jersey.—Complaint was received on June 20, 1902, in regard to this wreck, and on June 27, 1902, the sum of \$15 was allotted for the purpose of making an examination of the obstruction. The wreck was found to be the barge *Eldorado*, loaded with lumber, and was sunk in the Passaic River about 825 feet below the Erie Railroad bridge. The wreck was an obstruction to navigation, and was removed by the owner under direction of this office on July 5, 1903, at a cost to the United States of 60 cents.

Wrecks of two unknown canal boats and canal boat F. D. Tower, in Newark Bay, New Jersey.—Complaints having been received that there were several abandoned canal boats floating around the lower part of Newark Bay, the matter was investigated, and three of the wrecks were located, two on Bergen Point reef, and the *F. D. Tower* on the shore of Staten Island, opposite Bergen Point. An allotment of \$25 for an examination of these wrecks had been made on June 12, 1902. The wrecks in their positions were considered menaces to navigation, and an allotment of \$400 each for their removal was requested on July 24, 1902, and \$1,200 was allotted for that purpose on July 31, 1902. Proposals were invited, and the bid of Mr. John F. Baxter for doing

the work for the total sum of \$547 was accepted. The wrecks were entirely removed on August 27, 1902, and deposited in the contractor's yard at Weehawken, N. J. The total cost of removal, including examination, etc., was \$679.44.

Wreck of barge Will Sherman in Arthur Kill, New York and New Jersey.—This wreck was first reported to the Secretary of War on October 31, 1902, in letter of Vivian Bond & Co., agents for the Mountain Copper Company, with works at Elizabethport, N. J., and the matter was referred to the local engineer officer on November 6, 1902. An examination was made, and the wreck was found to be located in the Arthur Kill, near the wharf of the Mountain Copper Company, at Elizabethport. The wreck was worthless and abandoned, and the owner could not be found. Being an obstruction to navigation, an allotment of \$528 for its removal was requested on November 12, 1902, and that sum was allotted on November 18, 1902. Proposals were invited, and the bid of the Hudson River Lighterage Company for doing the work for the sum of \$243 was accepted. The wreck was finally removed on November 27, 1902, and was deposited in the contractor's yard at Edgewater, N. J. The cost of removal, including contingencies, was \$306.95.

Wreck of barge Antoinette Fisher in Elizabeth River, New Jersey.—This wreck was reported December 18, 1902. On examination the wreck was found to be loaded with brick and sunk in the channel of Elizabeth River, near the works of the Hygienic Chemical Company. The barge occupied half the width of the channel and was a serious obstruction to navigation. The wreck was floated and removed from the channel by the owners, under direction of this office, on December 28, 1902, at a cost to the United States of \$2.

Wreck of barge Leon Fisher in Passaic River, New Jersey.—Complaint was received on December 27, 1902, regarding this wreck, which on examination was found to be loaded with brick and sunk at the foot of Commercial street, Newark, and was an obstruction to navigation. The barge was completely removed from the channel by the owners, under direction of this office, January 19, 1903, at a cost to the United States of \$1.10.

Wrecks of two unknown canal boats in Newark Bay, New Jersey.—Complaints were received from the Merchants' Express and Transportation Company, of Newark, N. J., and other parties in regard to several wrecks in Newark Bay. On February 6, 1903, an allotment of \$25 was requested for the purpose of examining the wrecks, and that amount was allotted on February 9, 1903. An examination having been made, the wrecks were located, one in the channel east of the Passaic light-house and the other on the edge of the channel opposite Twenty-first street, Bayonne, N. J. The wrecks were useless canal boats, abandoned, and the owners were unknown. Being obstructions to navigation, an allotment of \$600 was requested on February 14, 1903, and that amount was allotted on March 2, 1903. Proposals were opened on March 12, 1903, but, the prices bid not coming within the estimated cost, an open-market agreement was made with Mr. John F. Baxter for doing the work for the sum of \$590. The wrecks were finally removed on April 10, 1903, and deposited in the contractor's yard at Weehawken, N. J. The total cost of removal, including examination, etc., was \$611.59.

Wreck of canal boat Laura E. Plantz in Raritan River, New Jersey.—

This wreck was reported by the Bloomfield Clay Company, of Metuchen, N. J., on February 16, 1903. The wreck was found to be sunk in the north side of the channel, near the wharf of the Bloomfield Clay Company, in such a manner as to obstruct navigation. The wreck was abandoned and worthless, and the owner could not be found. An allotment of \$600 was requested on February 20, 1903, and that sum was allotted on March 2, 1903. The bid of Mr. John F. Baxter to remove the wreck for \$487 was accepted, and the wreck was removed on April 6, 1903, and was finally deposited by the contractor in his yard at Weehawken, N. J. The cost of removal, including contingencies, was \$600.

Wreck of unknown canal boat in Arthur Kill, New York and New Jersey.—This wreck was reported on March 18, 1903, by Mr. J. R. Dewar, secretary of the board of commissioners of pilotage of New Jersey. The wreck was examined and found to be a worthless derelict lying near the center of the channel, with one end on the bottom and the other end floated to the surface, and in that location was a menace to navigation. A stake and a red lantern placed by the Port Reading Railroad Company marked its position by day and night. On March 24, 1903, an allotment of \$350 was made for its removal. Bids were invited, and that of Mr. John F. Baxter to do the work for the sum of \$239 was accepted. The wreck was removed on March 30, 1903, and deposited in the contractor's yard at Weehawken, N. J. The cost of removal, including contingencies, was \$285.41.

APPENDIX I.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA, AND CERTAIN WORKS IN DELAWARE BAY, DELAWARE.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, LIEUT. COL. C. W. RAYMOND AND CAPT. J. C. SANFORD, CORPS OF ENGINEERS.

IMPROVEMENTS.

- | | |
|---|--|
| 1. Delaware River, New Jersey and Pennsylvania. | 5. Removing sunken vessels or craft obstructing or endangering navigation. |
| 2. Construction of iron pier in Delaware Bay, near Lewes, Delaware. | 6. Construction of seagoing hydraulic dredges. |
| 3. Delaware Breakwater, Delaware. | |
| 4. Construction of harbor of refuge, Delaware Bay, Delaware. | |

HARBOR LINES.

7. Delaware River between Edgemoor and mouth of Christiana River.

ENGINEER OFFICE, UNITED STATES ARMY,
Philadelphia, Pa., July 18, 1903.

GENERAL: I have the honor to transmit herewith the annual reports for the works of river and harbor improvement of the Philadelphia district, also of dredge construction in my charge, for the fiscal year ending June 30, 1903.

Very respectfully, your obedient servant,

J. C. SANFORD,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

I 1.

IMPROVEMENT OF DELAWARE RIVER, NEW JERSEY AND PENNSYLVANIA.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 877; 1897, page 1192; 1898, page 1075; 1899, page 1317; 1900, page 1557; 1901, page 1310, and 1902, page 1025.

Expenditures during the past fiscal year have been applied to the following operations:

1. Surveys of the channel near Reedy Island, at Schooner ledge, at Greenwich piers, and from Edgemoor to Reedy Island.
2. Improvement of Baker, Salem Cove, and Duck Creek Flats shoals.
3. Improvement of Cherry Island Flats shoals.
4. Improvement of Schooner ledge.

These operations will be described in the above order. The localities referred to and previous operations thereat are described in the Annual Reports of the Chief of Engineers for 1896, pages 1075-1079, and 1899, pages 1317-1322.

1. SURVEYS.

Near Reedy Island.—This survey was made for the purpose of ascertaining the changes in the channel and cross sections of the river due to dredging and the construction of the bulkhead.

Schooner ledge.—This survey was made to determine the quantity of rock and overlying and adjacent material to be removed to obtain a channel of the project dimensions at this locality.

Greenwich piers.—This survey was made to ascertain the extent of shoaling in the channel in front of the piers.

Edgemoor to Reedy Island.—This survey, now in progress, is being made to ascertain the present condition of the channel as a basis for future improvement. It includes Cherry Island Flats shoal.

2. IMPROVEMENT OF BAKER, SALEM COVE, AND DUCK CREEK FLATS SHOALS.

During the past fiscal year operations under the general project have been in progress as follows:

Under a project submitted on June 4 and approved June 6, 1902, for the expenditure of about \$122,500 in widening the channel already dredged through Baker shoal to the full width of 600 feet and depth of 30 feet, and the construction of retaining banks within the timber bulkhead for the reception of dredged material, contract for this work was entered into with the American Dredging Company under date of June 26, 1902. Actual operations commenced on July 15, 1902, and were completed on November 8, 1902, 919,729 cubic yards of material having been excavated from the channel and deposited behind the timber bulkhead on the lower ends of Baker and Stony Point shoals, and 50,000 cubic yards of heavy material deposited in the construction of a retaining bank. By the work done under this contract the existing channel, 20,500 feet long, was increased to an average width of 590 feet, with a depth of 30 feet at mean low water.

Under a project submitted July 1 and approved July 7, 1902, for the expenditure of \$600,000 appropriated and \$2,400,000 additional authorized in the river and harbor act approved June 13, 1902, and a further project submitted April 3 and approved April 13, 1903, for the expenditure of \$1,400,000 appropriated in the sundry civil act approved March 3, 1903, this latter amount being part of the \$2,400,000

authorized in the river and harbor act above referred to, contracts for work have been entered into as follows:

Under date of September 9, 1902, with the American Dredging Company, of Philadelphia, for all the dredging required, estimated at 10,900,000 cubic yards, scow measurement, to obtain a channel of the project dimensions through Salem Cove and Duck Creek Flats shoals, including the widening of the channel at the bends and removal of shoals from the existing channel through Baker shoal, and the construction of retaining banks composed of clay, gravel, and bowlders, across the lower ends of basins A and B within the timber bulkhead for the reception of dredged material. Work under this contract was commenced on October 21, 1902, and is still in progress. Up to June 30, 1903, 2,790,006 cubic yards of material, scow measurement, had been removed from the channel, and 24,829 cubic yards of heavy material deposited in the retaining banks.

It having been found that material composed of clay, gravel, and bowlders was unsatisfactory, on account of the strong currents developed, for use in raising (above the plane of mean low water), the retaining bank across the lower end of basin A, the part of the contract with the American Dredging Company covering this work was abandoned by supplemental articles of agreement entered into with the company, under date of February 14, 1903. Arrangements were made for building this bank above low water by the deposit of from 15,000 to 18,000 tons of stone.

By further supplemental articles of agreement dated April 27, 1903, the retaining bank to be constructed of heavy material across the lower end of basin B, under the contract, was abandoned, and a timber bulkhead to be riprapped with stone was substituted therefor.

Under date of September 9, 1902, a contract was entered into with the Sanford & Brooks Company, of Baltimore, Md., for the construction of about 19,768 linear feet of bulkhead required to complete the basin for retaining dredged material. Work under this contract was commenced October 2, 1902, and is still in progress. Up to June 30, 1903, about 2,500 linear feet of bulkhead had been completed and 800 linear feet partly constructed.

Under date of September 27, 1902, a contract was entered into with Messrs. Hughes Bros. & Bangs, of Syracuse, N. Y., for furnishing and depositing about 112,500 tons of stone for the construction of buttresses and as riprap along the faces of the timber bulkhead already built and that yet to be constructed. By supplemental articles dated February 16, 1903, the quantity of stone to be deposited under this contract was increased to 130,500 tons, the additional quantity of stone to be placed in raising the retaining bank across basin A within the timber bulkhead, above the plane of mean low water.

Work under this contract was commenced October 10, 1902, and is still in progress. Up to June 30, 1903, the amount of stone deposited under the contract was 87,002 tons.

3. CHERRY ISLAND FLATS.

Under the projects above referred to, a contract dated February 14, 1903, was entered into with the F. K. Wills Construction Company for the construction of about 9,979 linear feet of timber bulkhead between the Edgemoor Iron Works and the mouth of Christiana River.

Work under this contract was commenced on May 18, 1903, and is still in progress. No part of the bulkhead has yet been completed; about 600 linear feet have been partly constructed.

4. SCHOONER LEDGE.

Proposals for the removal of rock and overlying and adjacent material from the channel were opened on April 2, 1903, and all bids rejected as being too high. The work was readvertised and new proposals opened on May 22, 1903. Only one bid was received, and as it was about \$55,000 in excess of the lowest bid received at the first letting it was also rejected.

MISCELLANEOUS.

In a project approved September 29, 1899, a reservation of \$18,400 from the appropriation of June 3, 1899, was made for the maintenance and repair of dikes. Of this amount the sum of \$1,587.46 has been expended, leaving on hand a balance of \$16,812.54 to be applied to the purposes for which allotted.

It is proposed to expend available funds on the completion of work under existing contracts and on further work under the general project.

IMPROVEMENT OF PHILADELPHIA HARBOR.

Up to June 30, 1902, 39 wharves between Allegheny avenue and Moore street, on the Delaware River water front of the city of Philadelphia, had been extended to the new pier-head line, and between Pearl and Mickle streets, Camden, five wharves had been similarly extended to the New Jersey pier-head line.

During the past fiscal year no piers on the Philadelphia water front within the limits of the Philadelphia Harbor improvement were fully extended to the new line.

The city of Philadelphia has constructed a new bulkhead along the bulkhead line from Vine to South streets, which has permitted the widening of Delaware avenue at that locality to 150 feet. The work of widening Delaware avenue between Vine and Green streets has been authorized, but no appropriations have yet been made for commencing this work.

Detailed information with reference to these subjects is given in a letter dated June 22, 1903, from Mr. Theodore C. Knauff, secretary of the board of harbor commissioners, which he has kindly prepared at my request. This letter and its accompanying papers are appended hereto.

Under date of June 10, 1901, regulations for the use of the main ship channel of the Delaware River below Philadelphia were prescribed by the Secretary of War, under authority of section 4 of the river and harbor act of August 18, 1894.

Harbor lines for the westerly shore of the Delaware River between Edgemoor and a point near the mouth of the Christiana River were established by the Assistant Secretary of War under date of November 7, 1902. A description of these lines is appended hereto.

Money statement.

July 1, 1902, balance unexpended	\$907, 465. 95
Amount appropriated by sundry civil act approved March 3, 1903.....	1, 400, 000. 00
	2, 307, 465. 95
June 30, 1903, amount expended during fiscal year	758, 957. 52
	1, 548, 508. 43
July 1, 1903, balance unexpended	1, 548, 508. 43
July 1, 1903, outstanding liabilities	165, 729. 84
	1, 382, 778. 59
July 1, 1903, balance available.....	1, 382, 778. 59
	1, 622, 521. 54
July 1, 1903, amount covered by uncompleted contracts.....	1, 622, 521. 54
	3, 254, 463. 26
{ Amount (estimated) required for completion of existing project	3, 254, 463. 26
{ Amount that can be profitably expended in fiscal year ending June	
{ 30, 1905, in addition to the balance unexpended July 1, 1903:	
{ For works of improvement.....	\$2, 000, 000. 00
{ For maintenance of improvement.....	100, 000. 00
	2, 100, 000. 00
Submitted in compliance with requirements of sundry civil act of June	
4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
July 4, 1836.....	\$15, 000	August 11, 1888	\$250, 000
June 10, 1872	10, 000	September 19, 1890	240, 000
March 3, 1873	115, 000	July 13, 1892.....	50, 000
June 23, 1874	60, 000	August 18, 1894	170, 000
March 3, 1875	30, 000	June 3, 1896	500, 000
August 14, 1876	40, 000	March 3, 1899.....	300, 000
June 18, 1878	110, 000	June 6, 1900	270, 500
March 3, 1879	201, 000	March 3, 1901	61, 500
June 14, 1880	235, 000	June 13, 1902	600, 000
March 3, 1881	250, 000	March 3, 1903.....	1, 400, 000
August 2, 1882	286, 000		
July 5, 1884.....	200, 000	Total	5, 604, 000
August 5, 1886.....	210, 000		

Total amount appropriated on present project to June 30, 1903, \$2, 555, 536. 74.

EXPENDITURES.

Under previous projects	\$3, 031, 650. 72
Under present project	1, 023, 840. 85
	4, 055, 491. 57
Total to June 30, 1903	4, 055, 491. 57

ABSTRACT OF CONTRACTS IN FORCE, WITH NAMES OF CONTRACTORS, DATE OF APPROVAL, OF BEGINNING WORK, AND EXPIRATION.

1. With the American Dredging Company, of Philadelphia, Pa., dated September 9, 1902, approved October 4, 1902, for dredging in the Delaware River at Duck Creek

^a One million dollars of this amount is yet to be appropriated under a provision contained in the river and harbor act of June 13, 1902, authorizing the Secretary of War to enter into contract or contracts for work under the existing project, to be paid for as appropriations may from time to time be made by law, not to exceed in the aggregate \$2,400,000, exclusive of the sum of \$600,000 appropriated by the same act.

Flats and Salem Cove shoals, at 13 $\frac{1}{2}$ cents per cubic yard, and constructing retaining banks composed of clay, gravel, and bowlders at 48 cents per cubic yard. Work to be commenced on or before November 7, 1902, and be completed on or before December 31, 1904.

2. With Sanford & Brooks Company, of Baltimore, Md., dated September 9, and approved October 18, 1902, for constructing timber bulkhead in the Delaware River at Baker and Stony Point shoals, to complete a basin for retaining dredged material, at the following prices: 17 $\frac{1}{2}$ cents per linear foot for round piles in place; \$37.50 per 1,000 feet B. M. for southern long-leaf yellow pine timber in place; 4 cents per pound for tie-rods, screw bolts, nuts, and washers in place, and 4 cents per pound for spikes in place. Work to be commenced on or before November 23, 1902, and be completed on or before August 31, 1903.

3. With Hughes Bros. & Bangs, of Syracuse, N. Y., dated September 27 and approved October 4, 1902, for furnishing and depositing stone in construction of butresses and as riprap at the timber bulkhead in the Delaware River near Reedy Island, at \$1.20 per ton of 2,000 pounds. Work to be commenced on or before December 7, 1902, and be completed on or before December 31, 1904.

4. With the F. K. Wills Construction Company, of Wilmington, Del., dated February 14 and approved February 25, 1903, for constructing timber bulkhead in the Delaware River between Edgemoor and mouth of Christiana River, at the following prices: 12 $\frac{1}{2}$ cents per linear foot for round piles in place; \$31.80 per 1,000 feet B. M. for southern long-leaf yellow pine timber in place; 2 $\frac{1}{2}$ cents per pound for screw bolts, nuts, and washers in place, and 2 $\frac{1}{2}$ cents per pound for spikes in place. Work to be commenced on or before April 1, 1903, and be completed on or before September 30, 1904.

COMMERCIAL STATISTICS.

The following statement concerning the foreign commerce of the Delaware River for the years ending December 31, 1901 and 1902, is compiled from reports of the Board of Trade, Commercial Exchange, and the Maritime Exchange of the city of Philadelphia:

Articles.	1901.	1902.
IMPORTS.		
	<i>Tons.</i>	<i>Tons.</i>
Asphalt and asphalt blocks	24,412	23,627
Cement	4,756	13,501
Chalk	44,213	41,121
Clay	54,449	58,330
Coal	11,220	11,220
Coal tar, and pitch of	1,213	1,676
Cork and corkwood	608	2,035
Cotton and cotton fabrics	4,137	4,082
Drugs and chemicals	89,673	154,922
Earthenware, china and stone ware	200	213
Fertilizers	9,511	2,962
Fruits	15,648	24,986
Glass, and manufactures of	1,460	2,086
Glue and glue stock	1,346	1,616
Groceries and provisions	8,624	30,983
Hair, and manufactures of	1,063	1,420
Hemp, jute, flax, and their fabrics	31,161	33,112
Hides and skins	9,872	11,446
Iron:		
Manufactured	9,060	80,453
Ore	332,651	339,880
Pig	16,898	219,049
Scrap	2,168	65,345
Leather, and manufactures of	181	231
Live stock and fowls	56	164
Mineral water	694	612
Molasses	66,195	6,254
Oil	3,281	7,579
Ores, metals, and manufactures of	1,258	2,211
Plants and seeds	6,547	4,722
Plaster of paris	28,498	41,095
Rags	2,147	3,182
Salt	17,688	18,053
Silk, and manufactures of	127	171
Stone, and manufactures of	1,576	2,041
Sugar	363,052	289,603

Articles.	1901.	1902.
IMPORTS—continued.		
	<i>Tons.</i>	<i>Tons.</i>
Sulphur:		
Crude	12, 086	21, 245
Ore	67, 756	77, 528
Tin	9, 556	14, 299
Tobacco	817	630
Wines and liquors	2, 044	1, 926
Wood pulp, paper, and manufactures of	9, 514	14, 896
Wood, and manufactures of	4, 124	12, 777
Wool and wool fabrics	7, 629	17, 630
Miscellaneous	11, 138	18, 289
Total	1, 279, 044	1, 679, 403
EXPORTS.		
Beef, pork, and products	69, 867	75, 558
Bricks	16, 715	3, 727
Bran, middlings, and mill feed	5, 592	4, 172
Cars and locomotives	1, 497	799
Coal	687, 274	566, 263
Corn and corn meal	444, 968	68, 785
Cotton, and cotton fabrics	2, 997	9, 720
Drugs and chemicals	6, 298	10, 034
Feed		4, 172
Fertilizers	261	273
Flour	237, 177	267, 310
Fruit	626	346
Glucose	17, 588	9, 328
Glue and glue stock	90	76
Groceries and provisions	10, 094	5, 967
Gun powder and explosives	161	504
Hay	1, 002	2, 616
Hides, leather, and manufactures of	903	1, 569
Iron:		
Manufactured	27, 316	14, 743
Pig	877	2, 424
Scrap	24	73
Live stock	13, 534	10, 861
Metals, other, and manufactures of	4, 207	3, 307
Molasses	42, 084	33, 487
Oats and oatmeal	64, 418	18, 826
Oil cake	50, 468	71, 139
Oils, lubricating	76, 337	92, 371
Oils, other	4, 650	1, 548
Paraffin	17, 689	21, 431
Petroleum, crude and refined	941, 916	1, 036, 303
Residium	24, 603	35, 514
Rye	710	1, 010
Seeds	872	6, 854
Soap, tallow, and grease	7, 609	11, 858
Stone, and manufactures of	13, 821	9, 371
Tobacco	4, 186	6, 320
Wheat	333, 922	264, 494
Wines and liquors	581	1, 022
Wood pulp, paper, and manufactures of	537	5, 534
Wood, and manufactures of	41, 974	49, 805
Miscellaneous	19, 160	19, 340
Total	3, 183, 584	2, 748, 839

Passengers arriving from and departing for foreign countries by river.

	1901.	1902.
Arrivals	17, 259	24, 394
Departures	7, 072	7, 427
Total	24, 331	31, 821

964 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Comparative statement of tons and values of exports and imports and revenue collected.

Year.	Exports.		Imports.		Revenue.
	Tons.	Value.	Tons.	Value.	
1894.....	1,861,578	\$37,441,000	1,164,572	\$51,553,704	\$8,456,183
1895.....	1,738,913	36,745,119	1,355,456	47,271,435	13,526,966
1896.....	1,875,081	42,431,100	1,151,723	39,807,278	12,657,803
1897.....	2,599,952	51,760,616	1,182,807	27,921,738	14,057,074
1898.....	3,019,006	59,392,047	949,097	37,516,707	19,818,783
1899.....	3,069,570	67,044,250	1,270,440	48,241,016	20,777,735
1900.....	3,513,526	81,145,966	1,316,554	49,186,877	21,775,201
1901.....	3,183,584	79,324,344	1,279,044	51,365,142	19,046,007
1902.....	2,748,839	76,022,896	1,679,408	55,064,776	22,360,362

Foreign entrances and clearances.

Class.	Entered from foreign ports.				Cleared for foreign ports.				Total.	
	With cargo.		In ballast.		With cargo.		In ballast.			
	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.	No.	Tons.
American vessels:										
Steam.....	46	51,218	2	1,372	17	20,432	27	28,763	92	101,785
Sail.....	109	56,130	1	1,021	62	44,125	7	4,089	179	106,365
Foreign vessels:										
Steam.....	676	1,306,226	204	439,669	694	1,534,068	154	146,653	1,728	3,426,616
Sail.....	72	52,533	27	46,382	71	87,443	14	7,553	184	193,911
Total.....	903	1,466,107	234	488,444	844	1,686,068	202	187,068	2,183	3,827,677

The following statement concerning the domestic and coastwise commerce of the Delaware River for the years ending December 31, 1901 and 1902, has been compiled from returns made to this office by shippers, consignees, and carriers:

Articles.	1901.		1902.	
	Tons.	Value.	Tons.	Value.
ARRIVALS.				
Asphalt.....	12,330	\$361,115	17,770	\$344,074
Bricks and terra cotta.....	30,967	86,373	27,664	75,543
Cement and plaster.....	28,338	104,635	3,420	28,792
Chemicals.....	82,563	2,368,603	101,290	4,354,684
Clay.....	5,030	8,483	5,615	9,900
Coal.....	493,761	1,558,889	330,327	1,222,067
Coal tar.....			13,100	73,370
Cotton.....	5,854	1,133,380	3,023	604,600
Fertilizers.....	73,409	880,240	65,245	861,703
Grain.....	44,279	954,352	103,998	2,014,975
Hay.....	6,829	36,788	4,074	25,508
Ice.....	137,392	206,746	114,000	196,000
Iron:				
Manufactured.....	80,360	2,537,942	36,815	2,102,340
Pig.....	57,633	823,621	102,101	1,796,011
Scrap.....	7,968	109,670	830	9,960
Ore.....			11,563	364,900
Lumber.....	961,743	12,661,662	845,520	26,154,180
Manure.....	42,055	48,574	42,600	50,900
Oysters and fish.....	35,125	1,193,260	64,869	1,445,057
Petroleum and products.....	41,279	583,871	297,937	5,882,327
Produce and fruit.....	86,795	2,859,820	24,007	1,827,420
Railroad ties.....	193,186	925,340	203,537	1,121,222
Sand.....	1,100,601	748,577	1,388,706	686,247
Stone:				
Building.....	21,104	105,220	71,502	188,525
Paving.....	50,285	67,033	63,844	212,994
Sugar.....	44,467	3,519,010		
Wood (cord).....	38,734	152,276	66,167	295,946
Miscellaneous.....	2,877,810	544,762,055	2,807,292	733,057,492
Total.....	6,569,797	578,792,535	6,816,816	785,005,737

Articles.	1901.		1902.	
	Tons.	Value.	Tons.	Value.
DEPARTURES.				
Asphalt	12, 576	\$368, 891	11, 334	\$139, 454
Bricks and terra cotta	121, 159	412, 728	27, 664	75, 543
Cement and plaster	3, 450	11, 310	2, 600	18, 000
Chemicals	84, 334	1, 952, 160	53, 220	2, 000, 556
Coal	8, 085, 591	36, 988, 161	6, 117, 246	24, 066, 876
Coal tar			30, 314	399, 814
Cotton	2, 684	630, 410	6, 224	1, 144, 800
Fertilizers	101, 723	1, 564, 188	86, 571	1, 515, 965
Grain	1, 022	19, 730	5, 015	129, 100
Hay	4, 556	30, 450	2, 288	32, 606
Ice	30, 878	46, 317	19, 000	33, 250
Iron:				
Manufactured	123, 511	4, 896, 443	89, 375	4, 215, 700
Pig	39, 078	541, 732	39, 711	696, 837
Scrap	6, 294	81, 760	10	120
Ore			818	150, 000
Lumber	77, 959	1, 016, 488	80, 523	1, 190, 591
Manure	181, 273	244, 291	86, 125	97, 250
Oysters and fish	162, 250	1, 633, 500	162, 850	1, 651, 000
Petroleum and products	334, 749	5, 707, 746	333, 071	5, 592, 346
Produce and fruit	13, 586	512, 341	1, 076	94, 125
Sand	1, 036, 148	718, 755	1, 031, 015	416, 535
Stone:				
Building	20, 512	99, 800	71, 502	176, 525
Paving	208, 070	291, 764	30, 591	86, 074
Wood (cord)	4, 650	23, 337	4, 060	22, 897
Miscellaneous	2, 402, 048	439, 568, 506	2, 305, 959	661, 201, 187
Total	13, 058, 099	497, 345, 288	10, 598, 151	705, 146, 041

Passengers arriving and departing from Philadelphia by river.

	1901.	1902.
Arrivals	1, 444, 452	1, 617, 342
Departures	1, 459, 235	1, 638, 015
Total	2, 903, 687	3, 255, 357

Domestic and coastwise arrivals and departures in cargo.

Class.	1901.		1902.	
	Arrivals.	Departures.	Arrivals.	Departures.
Steamers	a 17, 843	a 18, 745	a 17, 608	a 17, 265
Sailing vessels	4, 934	36, 060	3, 522	b 34, 341
Canal boats and barges	37, 245	48, 292	c 28, 127	d 38, 702
Rafts	863	11	429	298
Total	60, 885	103, 108	49, 686	90, 606

a Excluding tugboats and ferry boats.
b Including 32,000 oyster boats.

c Including 17,404 railroad lighters.
d Including 17,357 railroad lighters.

SUMMARY.*Freight movement.*

	1901.		1902.	
	Tons.	Value.	Tons.	Value.
Foreign:				
Arrivals	1, 279, 044	\$51, 365, 142	1, 679, 403	\$55, 064, 776
Departures	3, 183, 584	79, 324, 344	2, 748, 839	76, 022, 896
Domestic:				
Arrivals	6, 559, 997	578, 792, 535	6, 816, 816	785, 005, 737
Departures	13, 068, 099	497, 345, 288	10, 598, 151	705, 146, 041
Total	24, 090, 724	1, 206, 827, 309	21, 843, 209	1, 621, 239, 450

Vessel movement.

	1901.	1902.
Steam vessels, foreign trade, arriving	925	928
Sailing vessels, foreign trade, arriving	196	209
Steam vessels, foreign trade, departing	940	892
Sailing vessels, foreign trade, departing	188	154
Steam vessels, domestic trade, arriving	17,843	17,608
Sailing vessels, domestic trade, arriving	4,934	3,522
Canal boats and barges, domestic trade, arriving	37,245	28,127
Rafts, domestic trade, arriving	863	429
Steam vessels, domestic trade, departing	18,745	17,265
Sailing vessels, domestic trade, departing	36,060	34,341
Canal boats and barges, domestic trade, departing	48,292	38,702
Rafts, domestic trade, departing	11	298
Total	166,241	142,475

LETTER FROM MR. THEO. C. KNAUFF, SECRETARY OF THE BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA, PA., WITH REFERENCE TO THE IMPROVEMENT BY THE CITY OF THE HARBOR OF PHILADELPHIA BY MEANS OF THE WIDENING OF DELAWARE AVENUE AND THE EXTENSION OF PIERS BY PRIVATE OWNERS, DURING THE FISCAL YEAR ENDING JUNE 30, 1903, WITH TWO INCLOSURES.

BOARD OF HARBOR COMMISSIONERS FOR THE CITY OF PHILADELPHIA,
Philadelphia, Pa., June 22, 1903.

DEAR SIR: I beg to acknowledge the receipt of your communication under date of May 27, 1903, in which you asked to be furnished with a concise statement regarding the progress made by the city of Philadelphia since June 30, 1902, in the reconstruction of the water front along the Delaware River and in the advancement of wharves to the new pierhead line by the city and private owners.

Under the head of the improvement of the rivers and harbor I would state that as part of the plan for widening and improving Delaware avenue the city has acquired, for the sum of \$133,895.47, 138 feet of additional water frontage north of Race street pier, which sum was paid in settlement of damages and for the acquiring of the property. This makes in all a total of 363 feet 5½ inches of additional water frontage acquired by the city adjoining the city piers at Race, Arch, and Chestnut streets.

The grades on Delaware avenue, between Vine and South streets, are in process of readjustment, for which studies have been made. Plans and specifications have been drawn for the regrading and repaving of the avenue with granite blocks on concrete base with pitch and pebble joints, and for repaving the footway on the westerly side of the avenue with granolithic pavement. This work will be put in hand after the rails for the steam railways have been laid, the plans for the location of which, three tracks, and the proposed style of rail have been approved.

The pattern proposed to meet the requirements of a smooth surface for the street traffic is of the grooved girder type.

No appropriations have as yet been made to carry on the work of widening Delaware avenue north of Vine street, but the adjustments as to the amounts of damages by reason of the widening have been made with the owners, and the results of these negotiations have been reported to councils. These damages will amount to \$216,616 between Vine and Green streets.

A number of licenses have been granted for the extension of piers, but no extensions have been made since the last report.

The contract with the American Dredging Company for the improvement of the Delaware and Schuylkill rivers was finished in September, 1902. This contract was mentioned in the last report. The total amount expended under this contract for both the Delaware and Schuylkill rivers was \$234,480.77, of which \$110,525.26 was used in the improvement of the Schuylkill River. On that river 296,670 cubic yards of material were removed below Penrose Ferry bridge, and 68,654 cubic yards of material other than rock, and 17 cubic yards of material classified as rock, being bowlders, were removed from the channel above the bridge. On the Delaware, on Tinicum Island range, 538,937 cubic yards were taken, which gives a channel 600 feet wide and 26 feet deep at low water.

By an ordinance of councils passed June 27, 1902, \$400,000 was appropriated for additional dredging by the city on the rivers. This was voted upon by the people in the general loan bill and approved, but it required legislation before it could become available. It was finally arranged to apply the whole of this amount to the

improvement of the Schuylkill River, and on June 1, 1903, the mayor signed an ordinance which made the \$400,000 voted by the people available for work on that river.

Plans and specifications were prepared and proposals were received on March 23, 1903.

On June 12, 1903, the contract for the improvement of the Schuylkill River by the city of Philadelphia under the appropriation of \$400,000 was awarded to the American Dredging Company, who were the lowest bidders for the work. Operations under this contract will be commenced at an early date. The dredged material will be placed both east and west of Broad street on League Island Park.

I inclose herewith, marked "Exhibit A," copy of a letter from Mr. George S. Webster, chief engineer and surveyor of the city, giving all details in connection with these subjects.

I also inclose herewith, marked "Exhibit B," copy of a communication from Mr. George F. Sproule, secretary of the board of port wardens, containing a list of licenses granted by that board for the extension of piers in front of the city of Philadelphia up to June 1, 1903.

Very truly,

THEO. C. KNAUFF, *Secretary.*

Capt. J. C. SANFORD, *Corps of Engineers.*

EXHIBIT A.

DEPARTMENT OF PUBLIC WORKS, BUREAU OF SURVEYS,
Philadelphia, Pa., June 3, 1903.

DEAR SIR: Answering your letter of May 29, 1903, requesting information in relation to the reconstruction of the Delaware River water front, advancement of wharves by the city, and the improvement of the rivers and harbor, I would state that in the matter of widening Delaware avenue the city of Philadelphia, by reason of the settlement of the claim of the Uhler estate, has acquired additional water frontage of 138 feet north of Race street pier, paying in settlement for the damages and for acquiring the property, including interest, the sum of \$133,895.47, which makes a total of 363 feet 5½ inches of additional water frontage adjacent to city piers at Race street, Arch and Chestnut streets, which has been acquired by the city in settlement of claims for damages.

Studies have been made, plans and specifications drawn for the readjustment of the grades on Delaware avenue between Vine and South streets, and for the repaving with granolithic pavement of the footway on the westerly side of the avenue, for regrading and repaving the avenue with granite blocks on concrete base with pitch and pebble joints.

This work will necessarily be delayed until the rails for the steam railways have been laid.

After considerable discussion the location of the three tracks for steam-railway traffic, together with the style of rail, have been approved.

The rail approved is of the grooved girder type and appears to meet the requirements of a smooth surface for the traffic upon this avenue.

The widening of the avenue north from Vine street is still in the preliminary stage. The adjustments have been made with owners as to the amounts of damages that will be suffered by reason of the widening, and the result of these negotiations reported to councils. No appropriations have yet been made to carry on this work.

The sum necessary to settle the claims for damages between Vine and Green streets is \$216,616.

No additional piers have been extended into the Delaware River by the city of Philadelphia since the last report.

In the matter of river improvement, the contract with the American Dredging Company mentioned in the last Annual Report of the Engineer Department was carried to completion in September last.

Under this contract 538,937 cubic yards of material was dredged from the Tinicum Island range, making the channel 26 feet deep at low water and 600 feet wide; 296,670 cubic yards of material was dredged from the Schuylkill River below Penrose Ferry bridge, and 68,654 cubic yards of material other than rock and 17 cubic yards of boulders, classified as rock, from the channel above the bridge.

The total amount expended for both the Delaware and Schuylkill rivers under this contract was \$234,480.77, of which \$110,525.26 was spent upon the Schuylkill River.

Councils by ordinance of June 27, 1902, appropriated the sum of \$400,000 to con-

tinue the work of dredging. Certain legislation is still pending before this amount can become available.

Plans and specifications were prepared and proposals received March 23, 1903. The contract was awarded to the American Dredging Company.

The material to be removed is intended to be placed upon League Island Park, both east and west of Broad street.

Yours truly,

G. S. WEBSTER, *Chief Engineer.*

Mr. THEO. C. KNAUFF,
Secretary, Board of Harbor Commissioners.

EXHIBIT B.

BOARD OF PORT WARDENS FOR THE PORT OF PHILADELPHIA, PA., *Philadelphia, Pa., June 3, 1903.*

DEAR SIR: Replying to your favor of May 29, 1903, I beg to send you the following list of licenses granted by the board of wardens for the port of Philadelphia for pier extensions from June 30, 1902, to June 1, 1903:

August 20, 1902.—The Neafie & Levy Company, to extend pier 60 north.

August 20, 1902.—W. S. Taylor and Philadelphia and Reading Railway Company, jointly, to extend piers 42 and 43 north.

August 20, 1902.—Pennsylvania Railroad Company, to build an extension to piers Nos. 13 and 15 north.

January 5, 1903.—Edwin B. Malone, to extend pier No. 44 north.

March 2, 1903.—People's Passenger Railway Company and the Real Estate Holding Company, jointly, to extend piers 34 and 33 north.

May 4, 1903.—Sun Company, to build a pier in front of property in borough of Marcus Hook.

June 1, 1903.—William M. Lloyd Company, Limited, to fill up the intervening dock between piers 68 and 69 north and extend a pier.

Very truly, yours,

GEO. F. SPROULE, *Secretary.*

Mr. THEO. C. KNAUFF,
Secretary, Board of Harbor Commissioners.

I 2.

CONSTRUCTION OF IRON PIER IN DELAWARE BAY, NEAR LEWES, DELAWARE.

An account of this work is contained in the Annual Reports of the Chief of Engineers for 1896, page 920, and for 1900, page 1574.

During the past fiscal year no work has been done or liabilities incurred.

It is proposed to hold the sum of \$820.60, which remains available, for maintenance and repairs as needed.

The funds now available are considered sufficient for present needs.

Money statement.

July 1, 1902, balance unexpended	\$820. 60
July 1, 1903, balance unexpended	820. 60

APPROPRIATIONS.

Act of—		Act of—	
July 15, 1870.....	\$225, 000	June 14, 1880.....	\$10, 000
June 23, 1874.....	10, 000	March 3, 1881.....	10, 000
March 3, 1875.....	25, 000	August 2, 1882.....	13, 000
March 3, 1875.....	15, 000	April 4, 1890.....	10, 000
August 14, 1876.....	30, 000	June 3, 1896.....	7, 660
June 18, 1878.....	20, 000		
March 3, 1879.....	10, 500	Total.....	386, 160

EXPENDITURES.

Total to June 30, 1903	\$385, 339. 40
------------------------------	----------------

I 3.

IMPROVEMENT OF DELAWARE BREAKWATER, DELAWARE.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1896, page 922; for 1897, page 1214; for 1898, page 1094, and for 1901, page 1323.

During the past fiscal year no work has been done nor expenses incurred.

The funds now available are considered sufficient for present needs, and it is proposed to hold the sum of \$874.38, the available balance, for maintenance and repairs as needed.

The commercial statistics of the harbor at and in the vicinity of this breakwater are given in connection with the report on the Harbor of Refuge, Delaware Bay, Delaware.

Money statement.

July 1, 1902, balance unexpended	\$874. 64
July 1, 1903, balance unexpended	874. 64
July 1, 1903, outstanding liabilities	. 26
July 1, 1903, balance available	874. 38

APPROPRIATIONS.

Act of—		Act of—	
May 7, 1822.....	\$22, 700. 00	June 23, 1866.....	\$107, 910. 00
May 23, 1828.....	250, 000. 00	March 2, 1867.....	109, 493. 70
April 23, 1830.....	162, 000. 00	August 2, 1882.....	125, 000. 00
March 2, 1831.....	208, 000. 00	July 5, 1884.....	75, 000. 00
July 3, 1832.....	270, 000. 00	August 5, 1886.....	56, 250. 00
March 3, 1833.....	270, 000. 00	August 11, 1888.....	100, 000. 00
June 28, 1834.....	270, 000. 00	September 19, 1890...	80, 000. 00
March 3, 1835.....	100, 000. 00	July 13, 1892.....	50, 000. 00
July 2, 1836.....	100, 000. 00	August 18, 1894.....	50, 000. 00
July 4, 1836 (survey)....	1, 000. 00	June 3, 1896.....	80, 000. 00
March 3, 1837.....	141, 000. 00		
July 7, 1838.....	150, 000. 00	Total.....	2, 808, 353. 70
August 30, 1852.....	30, 000. 00		

970 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

EXPENDITURES.

Total to June 30, 1903 \$2,807,479.06
 Total under present project to June 30, 1903..... 615,375.36

COMMERCIAL STATISTICS.

During the year ending December 31, 1902, the following vessels called at Delaware Breakwater for the reasons given:

	Steamers.	Ships.	Barks.	Schooners.	Barges.	Total.
For orders.....	59	7	19	12	.....	97
For harbor.....	13	4	33	720	212	982
In distress.....	1	1	.....	3	1	6
Total.....	73	12	52	735	213	1,085

In addition to the above, a large number of craft under 30 tons have used the breakwater for harborage.

I 4.

CONSTRUCTION OF HARBOR OF REFUGE, DELAWARE BAY, DELAWARE.

An account of this improvement is contained in the Annual Reports of the Chief of Engineers for 1897, page 1216; for 1901, page 1325, and for 1902, page 1036.

The breakwater provided for under the project was completed December 11, 1901.

During the past fiscal year the work of constructing 10 ice piers under an existing contract with Messrs. Hughes Bros. & Bangs, dated September 7, 1900, was continued and completed on November 22, 1902, 31,738 tons of stone being placed in the work, the total amount placed in the 10 ice piers being 71,300 tons.

Under a project submitted June 7, 1902, and approved June 30, 1902, an emergency contract, dated August 4, 1902, was entered into with Messrs. Hughes Bros. & Bangs for the expenditure of about \$100,000 in the construction of additional ice piers. Work under this contract commenced August 4, 1902, and was completed on June 19, 1903. Five additional ice piers were constructed by the deposit of 37,673 tons of stone.

Under date of November 19, 1902, a report was submitted in accordance with the provisions of the river and harbor act of March 13, 1903, regarding the necessity of further protection, if any, from northwest winds. This report has not yet been printed.

The funds now on hand will be held for examinations and maintenance and repair of the breakwater.

During the past fiscal year the survey of the breakwater harbor, commenced in April, 1902, was completed. This survey indicates that little or no shoaling is in progress within the area protected by the breakwater.

Money statement.

July 1, 1902, balance unexpended	\$148,568.18
June 30, 1903, amount expended during fiscal year	147,096.84
July 1, 1903, balance unexpended	1,471.34
July 1, 1903, outstanding liabilities	.46
July 1, 1903, balance available	1,470.88

APPROPRIATIONS.

Act of—		Act of—	
June 3, 1896	\$5,000	June 6, 1900	\$450,000
June 4, 1897	394,334	March 3, 1901	213,000
July 1, 1898	800,000		
March 3, 1899	377,000	Total	2,239,334

EXPENDITURES.

Total to June 30, 1903	\$2,237,862.66
------------------------------	----------------

I 5.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

(1) On July 3, 1902, the schooner *Mary E. Insley* was capsized and sunk in Delaware Bay near Cross Ledge light-house. The wreck being considered a dangerous obstruction to navigation by small vessels and oyster boats frequenting that locality, its removal was recommended. The owner having abandoned the wreck in August, 1902, a contract for its removal for the sum of \$392 was entered into by the United States with Charles T. Johnston, of Lewes, Del., under date of September 8, 1902. The work of removal was completed September 27, 1902.

(2) In March, 1902, the schooner *Milton R. Studhams* and the sloop *Mary W. Meerwald* were sunk in Delaware Bay, the former about 5½ miles above the Ship John light-house and the latter near False Egg Island Point. These wrecks being considered dangerous obstructions to navigation, their removal was recommended. Under date of December 8, 1902, contract was entered into with Messrs. Van Sant & Boehm, of Atlantic City, N. J., for the complete removal of all parts of the wrecks and their contents from the waterway, for the sum of \$382 for the *Milton R. Studhams*, and \$172 for the *Mary W. Meerwald*. The work of removing the wreck of the *Milton R. Studhams* was completed December 19, 1902, and of the *Mary W. Meerwald* January 23, 1903.

(3) On February 4, 1903, the forward section of the barge *Harry E. Bird*, said to contain 130 tons of coal, was sunk in Delaware River in midchannel, opposite League Island, Pa. The wreck being considered an especially dangerous obstruction to navigation, its removal was recommended. A contract for its removal, for the sum of \$335, was entered into by the United States with John J. Williams & Co., of

Chester, Pa., under date of April 29, 1903. The work of removal was completed May 19, 1903.

(4) In September, 1895, the three-masted schooner *Lottie K. Friend*, with a cargo of coal, was sunk in Delaware Bay in collision with another vessel about 1½ miles west from Ship John light. The wreck being considered a dangerous obstruction to navigation, its removal was recommended. Under date of February 8, 1897, a contract was entered into with Thomas Poynter and Elijah D. Register, of Lewes, Del., for the removal of the wreck for the sum of \$1,100, the work to be completed on or before April 25, 1897. At the close of the fiscal year ending June 30, 1897, the removal of the wreck had been commenced, but had not been completed. During the fiscal year ending June 30, 1898, no additional work had been done toward the removal of the wreck under the above contract, and on June 16, 1898, it was recommended that the contract be annulled and the remaining wreckage be removed by dredging at some time when dredging operations were in progress in the neighborhood. This recommendation was approved on June 18, 1898. Since that time nothing has been done toward the removal of the wreck.

I 6.

CONSTRUCTION OF SEAGOING HYDRAULIC DREDGES.

1. DREDGE FOR IMPROVING HARBOR AT CHARLESTON, S. C.

For work (70.3 per cent) previously performed under contract for construction of a wooden-hull, single-screw suction dredge, see pages 1166-1167, Appendix N, Annual Report of the Chief of Engineers for 1902.

Operations during fiscal year ending June 30, 1903.—Work was carried slowly forward on the hull and machinery. The propelling machinery was built by the Craig Shipbuilding Company, of Toledo, Ohio. Propelling machinery was tested under steam on August 13, 1902, and was accepted as being satisfactory. This engine, for some reason, was not sent to Petersburg until March 28, 1903, and arrived at Petersburg during the early part of May. Installation was well advanced at end of fiscal year.

The boilers were built by the Newport News Shipbuilding Company, Newport News, Va. They were inspected in the early part of 1902, and delivered at Petersburg the latter part of March, 1903; installation was begun at once. While lowering the starboard boiler into the hold on May 18, 1902, one of the slings carrying the boiler parted, dropping the boiler about 18 feet into the hold. The boiler struck on one of the steel boiler saddles, the after strake of the boiler shell plating was punctured, and the shell of the combustion chamber was dented. The boiler was taken to Newport News for repairs, which are not yet completed. Pumping machinery was built by the Joseph Edwards Company, of New York. The installation of same is about completed. The dredging, suction, and discharge pipes have been finished and installed.

Work on the hull has continued slowly, being constantly delayed on account of lack of material of all kinds. The hull was successfully

launched on October 18; an attempt to launch had been made on October 16, but, owing to the ground ways settling the launch was postponed until the 18th and then successfully carried out. The workmanship on the hull is of a very fair character; the joiner work is well advanced, the after deck house, crew's quarters aft and forward being finished, the forward deck and pilot house nearly finished. The workmanship and finish of the joiner work is of a very high order. Steam piping and plumbing is nearly finished, ship's rigging and deck fittings are in place; the whole contract is about 90 per cent completed. The probabilities are that the ship will be ready for her trial trip early in the ensuing year.

The expenditures are included in the money statement for improving harbor at Charleston, S. C.

List of contracts in force.

Contract for—	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Constructing wooden-hull seagoing suction dredge, complete.	Petersburg Iron Works Co.	Jan. 15, 1901	Jan. 31, 1901	a Nov. 24, 1901

a Time limit waived.

2. DREDGE FOR IMPROVING PASSES OF THE MISSISSIPPI RIVER.

For work (33.8 per cent) previously performed under contracts for construction of steel-hull twin-screw suction dredge, see pages 1173-1174, Appendix N, Annual Report of the Chief of Engineers for 1902.

Operations during the fiscal year ending June 30, 1903.—From June 30 to December 23, 1902, work on this dredge progressed rapidly. The percentage of work done is as follows:

At the end of—

July the contract was 41.249 per cent complete.

August the contract was 48.277 per cent complete.

September the contract was 53.407 per cent complete.

October the contract was 58.258 per cent complete.

November the contract was 70.472 per cent complete.

December the contract was 71.3 per cent complete.

The boilers were built by the Lake Erie Boiler Works of Buffalo, N. Y., and delivered at Richmond, Va., November 18, 1902; the pumping machinery, built by the Bucyrus Company of South Milwaukee, Wis., was delivered at Richmond, September 13, 1902.

On December 23, 1902, the Trigg Company was placed in the hands of a receiver, no construction work being done since that time. The present condition of the dredge is:—Shell plating complete, except 12 plates at the forward end of dredge; deck beams and frames all in place; bulkheads all in place; deck plating all in place and 90 per cent riveted. The propelling machinery is well advanced, the main engines, thrust bearings, shafting and propellers being nearly complete. The steam fitting and plumbing is well in hand, joiner work is finished as far as possible in the shops. The total percentage of contract completed is 71.3.

The company having failed to reorganize and resume work as at first expected, a request was made on May 19, 1903, to have the dredge finished by the Navy Department.

Three watchmen were subsequently engaged to look after the dredge and property. All the material in the yard pertaining to this dredge has been sorted out and marked preparatory to putting same on board. An inventory of all material pertaining to this dredge in the shipyard was made on June 28, and a copy of same given to the United States Naval Constructor in charge of the Navy Department work at Richmond.

Application to the courts by creditors to declare the Trigg Company bankrupt was denied in the latter part of June.

Amount expended to close of fiscal year ending June 30, 1903, \$160,960.01.

Money statement.

June 30, 1903, amount expended during fiscal year	\$97,062.39
July 1, 1903, outstanding liabilities	76.52
July 1, 1903, amount covered by uncompleted contracts	133,370.87

3. DREDGE FOR IMPROVING CUMBERLAND SOUND, GEORGIA AND FLORIDA.

For work (57.7 per cent) previously performed under contract for construction of wooden hull, single-screw suction dredge, see pages 1174-1175, Appendix N, Annual Report of the Chief of Engineers for 1902.

Operations during the fiscal year ending June 30, 1903.—Propelling machinery was built by the Bath Iron Works, Bath, Me. The propelling engine was placed on board September 24, 1902; was tested under steam November 20, 1902.

Boilers were built by Bath Iron Works, Bath, Me. Boilers were placed on board September 5, 1902. Auxiliary machinery was placed on board September 12, 1902. Pumping machinery was built by the Joseph Edwards Company; placed on board October, 1902.

Progress on the hull and machinery was satisfactory from the time of last report. Work was carried forward until September 2, 1902, when the dredge was launched. On September 3, 1902, the dredge was towed to Bath, Me., to receive her machinery. All work of machinery installation was finished ready for trial December 6, 1902. Trial was made on December 11, 12, and 13. Speed trial on December 11, resulted in an average speed of $9\frac{1}{8}$ miles per hour, the engines developing 1,050 I. H. P.

December 12 an attempt was made to test the dredging pumps, but almost immediately after starting, both drags fouled on a submerged obstruction, parting both suction pipes. The gate mechanism was tried and operated satisfactorily.

December 13 the dredging pumps were tested, about 700 cubic yards of material being pumped. All machinery and pumps worked satisfactorily. Snowstorm prevented further test.

Dredge left Bath, Me., December 22, for Newport News, arriving December 25, 5 a. m., everything working satisfactorily. Went into dry dock at Newport News for painting bottom, etc. Came out of dry dock December 27. Left Newport News for Charleston, S. C., January 4, 1903, arriving at Charleston January 7, everything working satisfactorily. Left Charleston, S. C., January 8. Arrived at Fernandina, Fla., January 9. The dredge was made ready for work and went on preliminary test trip January 15, 1903. On January 16 she

went out for actual work on shoal. The following is a statement of work done from January 16 to May 26, inclusive:

Total number of cubic yards dredged	386,479
Total number of loads	564
Average yards per load	685.2
Total hours actual time pumping with one or both pumps.....	510.7
Average time pumping one load, minutes	54.3
Average yards pumped per minute.....	12.4
Highest yards pumped per minute.....	24.1
Total time to go to and from dump, hours.....	302.7
Total miles to and from dump.....	1,162

The large percentage of time lost should be principally charged to breakages caused by an inexperienced crew, and the report for the following six months will no doubt show a very material increase in output. The *Cumberland* was turned over to Lieut. Col. James B. Quinn, Corps of Engineers, on May 27, 1903.

Money statement.

June 30, 1903, amount expended during fiscal year	\$73,338.84
July 1, 1903, outstanding liabilities	204.30
July 1, 1903, amount covered by uncompleted contract.....	2,625.00

Emergency contract in force.

Contract for—	Name of contractor.	Date of contract.	Date of beginning.	Date of completion.
Furnishing certain parts of pumping machinery and installing all pumping machinery on dredge.	Bath Iron Works.	Dec. 2, 1901	Depending on completion and delivery of pumps and engine by Jos. Edwards & Co.	Upon completion and delivery of suction-pipe blocks by Ellicott Machine Co., July 17, 1903.

4. DREDGE FOR IMPROVING MOUTH OF COLUMBIA RIVER, OREGON AND WASHINGTON.

Informal instructions for converting the U. S. Army transport *Grant* into a seagoing hydraulic suction dredge were received in the early part of October, 1902.

Work on the drawings was immediately started at Bath, Me., and were completed in December, and on December 20, 1902, a contract was made with the Ellicott Machine Company, of Baltimore, Md., for furnishing two triple-expansion pumping engines of 500 I. H. P. directly connected to two 20-inch pumps for \$15,500; dates for finishing these engines and pumps to be March 15 and April 15, respectively. A supplementary contract with this firm was made on April 6, 1903, providing for some changes in pumps and engines that were considered desirable. Great delay has been experienced in completing this contract, but both sets will probably be completed in July.

Emergency contracts were entered into with various firms for certain auxiliary machinery, all of which has been completed except the hoisting engines which are nearly completed.

Bids for converting the *Grant* into a dredge were received and opened January 3, 1903, and all were rejected as being excessive. Under advertisement, with certain changes in the plans, bids were again received on January 29, 1903. These being unsatisfactory,

arrangements were made with the Navy Department to do the work at the Mare Island Navy-Yard, Cal. Under this arrangement work was commenced February 23, 1903, and has progressed very favorably from that time. A probable saving of about \$40,000 will be effected by having the work done under this arrangement. At the end of the fiscal year the bins, gates, gate mechanism, overflows, suction and discharge pipes were practically completed. The main engines and boilers had been overhauled and repaired, the crew's quarters had been arranged and all unnecessary items of machinery, quarters, and outfit had been removed. The detailed reports show the whole work to be 82.56 per cent completed.

Money statement.

June 30, 1903, amount expended during the fiscal year	\$116,425.27
July 1, 1903, outstanding liabilities	2,748.41
July 1, 1903, amount covered by uncompleted contracts.....	10,514.95

Emergency contract in force.

Contract for—	Name of contractor.	Date of contract.	Date of beginning.	Date of completion.
Two triple-expansion engines and two 20-inch dredging pumps.	Ellicott Machine Co..	Dec. 20, 1902	Dec. 20, 1902	^a Mar. 15, 1903, and Apr. 15, 1903.

^a Time limit waived.

5. DREDGE FOR IMPROVING ST. JOHNS RIVER, FLORIDA.

The river and harbor act approved June 13, 1902, appropriated \$150,000 for the construction of a seagoing suction dredge for improving St. Johns River, Florida.

Work of preparing the drawings and specifications for the dredge under the above act was started in August, 1902. The plans and specifications were completed during September, 1902, and submitted to the Chief of Engineers for approval. The work was advertised October 2, 1902, proposals to be opened November 12, 1902. Six bids were received ranging from \$156,749 to \$174,145.

The lowest bid being in excess of the appropriation, the specifications were modified and the dredge was readvertised November 26, 1902, under a ten days' notice, to be opened December 6. Under this advertisement five bids were received, the lowest being that of the James Reilly Repair and Supply Company, of New York, N. Y., under which they agreed to build the dredge as per the revised specifications for the sum of \$150,000. This bid was accepted and the work contracted for, the time of beginning being March 12, 1903, and time of completion February 25, 1904.

The plans and specifications provided for a seagoing hydraulic suction dredge 200 feet long over all, 185 feet long between perpendiculars, beam 40 feet, molded depth 23 feet 2 inches, capacity about 800 cubic yards of sand.

The hull was sublet to the Greenport Basin and Construction Company, of Greenport, Long Island. Work was started during January in the shipyard, orders being given for the timbers for stem, stern-post, keelsons, and frames; also the white pine for the joiner work.

Work on the detail drawings for hull and machinery was immediately started.

Contract was made by the James Reilly Repair and Supply Company with the Brown & Miller Company, of Jersey City, N. J., for the pumps and propelling machinery.

Contract was made by the James Reilly Repair and Supply Company with the Morgan Iron Works, of New York City, for the pumping engines.

Fairly good progress has been made on the hull and joiner work of this dredge. At the end of the fiscal year all the frames had been erected; 24 deck beams, 4 strakes of ceiling, all filling under propelling engines and boilers, fitting for all side lights and headers for after bin gates were in place, and a good portion of the frames dubbed for planking. The plates, coamings, studding, and carlings for joiner work were completed. Detail reports show hull to be about 19.7 per cent completed.

Progress on the machinery equipment has been fairly good. The propelling-engine cylinders, frames, crank shaft, reversing engine, pistons, and other details are partially completed. Detail reports show engine to be about 40 per cent completed.

The pumping-engine cylinders, frames, crank shaft, pistons, etc., have been partially completed. Detail reports show the engines to be about 40 per cent completed.

The boilers are about 75 per cent completed.

The whole contract is about 16.3 per cent completed. Indications are that good progress will be made from now on, as ample material is in hand and all preliminary work has been completed.

Money statement.

June 30, 1903, amount expended during fiscal year	\$16, 223. 65
July 1, 1903, outstanding liabilities	101. 37
July 1, 1903, amount covered by uncompleted contracts	136, 500. 00

Contract in force.

Contract for—	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Constructing one wooden hull seagoing suction dredge complete.	James Reilly Repair and Supply Co.	Feb. 21, 1903	Mar. 12, 1903	Feb. 25, 1903

6. DREDGE FOR IMPROVING HARBOR AT PENSACOLA, FLA.

The river and harbor act approved June 13, 1902, appropriated \$150,000 for the construction of a seagoing suction dredge for improving the harbor at Pensacola, Fla.

Work of preparing the drawings and specifications for the dredge under the above act was started in August, 1902. The plans and specifications were completed during September, 1902, and submitted to the Chief of Engineers for approval. The work was advertised October 2, 1902, proposals to be opened November 12, 1902. Six bids were received, ranging from \$156,749 to \$174,145.

The lowest bid being in excess of the appropriation, the specifications were modified and the dredge was readvertised November 26,

1902, under a ten days' notice, to be opened December 6. Under this advertisement five bids were received, the lowest being that of the James Reilly Repair and Supply Company, of New York, N. Y., under which they agreed to build the dredge as per the revised specifications for the sum of \$150,000. This bid was accepted and the work contracted for, the time of beginning being April 15, 1903, and time of completion May 31, 1904.

The plans and specifications provided for a seagoing hydraulic suction dredge 200 feet long over all, 185 feet long between perpendiculars, beam 40 feet, molded depth 23 feet 2 inches, capacity about 800 cubic yards of sand.

The hull was sublet to the Greenport Basin and Construction Company, of Greenport, Long Island. Work was started during January in the shipyard, orders being given for the timbers for stem, sternpost, keelsons, and frames; also the white pine for the joiner work. Work on the detail drawings for hull and machinery was immediately started.

Contract was made by the James Reilly Repair and Supply Company with the Brown & Miller Company, of Jersey City, N. J., for the pumps and propelling machinery.

Contract was made by the James Reilly Repair and Supply Company with the Morgan Iron Works, of New York City, for the pumping engines.

Fairly good progress has been made on the machinery equipment. The shipbuilders have been delayed considerably on account of mills not supplying the ship timbers on time.

At the end of the fiscal year the keel blocks were all laid and launching berth provided. Keel and shoe are finished. Rudder and sternpost are ready for erection. Thirty-two frames are ready for erection and four more have been molded. Detail reports on the hull show the same to be 1.6 per cent completed. Progress on the propelling and pumping machinery has been more favorable. The cylinders, frames, crank shaft, and reversing engine, and other details for the propelling engines are partially completed. Detail reports show same to be about 40 per cent completed. The cylinders, frames, crank shaft, pistons, etc., of the pumping engines have been partially completed. These engines are about 40 per cent completed. The boilers are 75 per cent completed.

The whole contract is about 4.6 per cent completed. Indications are that more rapid progress will be made from now on, as ample material is in hand, and all preliminary work has been finished. About twenty frames will probably be erected by July 20.

Money statement.

June 30, 1903, amount expended during the fiscal year.....	\$2,928.44
July 1, 1903, outstanding liabilities	100.62
July 1, 1903, amount covered by uncompleted contracts.....	150,000.00

Contract in force.

Contract for—	Name of contractor.	Date of approval.	Date of beginning.	Date of completion.
Constructing one wooden hull seagoing suction dredge complete.	James Reilly Repair and Supply Co.	Mar. 30, 1903	Apr. 15, 1903	May 31, 1904

7. DREDGE FOR IMPROVING NEW YORK HARBOR, NEW YORK.

Under authority of the Chief of Engineers, dated December 13, 1902, for the construction of two seagoing hydraulic suction dredges for work in New York Harbor, work on drawings and specifications for the above dredges was begun in December, 1902, and completed in the early part of April, 1903. The plans provide for a steel, twin-screw dredge 288 feet over all, 274 feet between perpendiculars, 47.5 feet molded beam, 25 feet molded depth. The plans and specifications were submitted to the Chief of Engineers April 25, 1903.

The work was advertised May 14, 1903, and proposals were opened June 30, 1903. Four bids were received, ranging from \$304,000 to \$410,000 for each dredge. The award of the contract for building two dredges as per specifications to the Maryland Steel Company, of Sparrows Point, Md., the lowest bidder, for the sum of \$304,000 each, was recommended.

Money statement.

June 30, 1903, amount expended during the fiscal year.....	\$2, 145. 61
July 1, 1903, outstanding liabilities.....	171. 10

8. DREDGE FOR IMPROVING HARBORS ON LAKE ERIE.

The Secretary of War, under date of March 18, 1903, authorized the construction of a seagoing hydraulic suction dredge for work in the harbors at Toledo, Sandusky, Cleveland, Fairport, Ashtabula, and Conneaut, Lake Erie. Work on the drawings and specifications was started in the latter part of April, 1903, and completed in the early part of June. They were submitted for approval to the Chief of Engineers June 2, 1903.

The specifications provide for a steel, twin-screw dredge, 177 feet long over all, 166 feet between perpendiculars, 38 feet molded beam, 19 feet molded depth.

Under advertisement dated June 18, 1903, bids for the construction of this dredge will be opened July 18, 1903.

Money statement.

June 30, 1903, amount expended during the fiscal year.....	\$412. 72
July 1, 1903, outstanding liabilities.....	96. 32

9. DREDGE FOR IMPROVING HARBORS ON LAKE MICHIGAN.

Under authority of the Secretary of War, dated March 18, 1903, for the construction of a seagoing hydraulic suction dredge for work in the harbors at St. Joseph, Saugatuck, Black Lake, Grand River, Ludington, Manistee, Portage Lake, and Frankfort, Lake Michigan, work on the drawings and specifications was started in the latter part of April, 1903, and completed in the early part of June, and were submitted to the Chief of Engineers June 2, 1903.

The plans and specifications provide for a steel, twin-screw dredge 177 feet long over all, 166 feet between perpendiculars, 38 feet molded beam, 19 feet molded depth.

Under advertisement dated June 18, 1903, bids for the construction of this dredge will be opened July 18, 1903.

Money statement.

June 30, 1903, amount expended during the fiscal year.....	\$407.25
July 1, 1903, outstanding liabilities	97.38

10. DREDGE FOR IMPROVING HARBOR AT SAVANNAH, GA.

Under the authority of the Secretary of War, dated April 30, 1903, for the construction of a seagoing hydraulic suction dredge for work in the Savannah Harbor, work on the drawings and specifications was started in the early part of May, 1903. The pencil drawings and 50 per cent of the tracings were finished by the end of the fiscal year.

The specifications provide for a steel, twin-screw dredge, length over all 177 feet, between perpendiculars 166 feet, molded beam 38 feet, molded depth 19 feet.

No expenditures were made to June 30, 1903.

11. DREDGE FOR IMPROVING HARBOR AT KEY WEST, FLA.

Under the authority given by the Secretary of War, dated April 20, 1903, for the construction of a seagoing hydraulic suction dredge for work at Key West Harbor, work on the drawings and specifications was started in May, 1903. The drawings and specifications were about 50 per cent completed by the end of the fiscal year. The specifications provide for a wooden hull, single-screw dredge, about 140 feet long, 31½ feet beam, and 13½ feet depth, the estimated cost being \$80,000.

No expenditures were made to June 30, 1903.

12. CONSTRUCTION OF SUCTION DREDGE FOR RIVER WORK, SOUTHWEST PASS, MISSISSIPPI RIVER.

Authority having been granted for the construction of a large hydraulic dredge for inside work in the Southwest Pass, Mississippi River, the preparation of plans and specifications therefor was begun in the summer of 1902, in the office of the Mississippi River Commission at St. Louis, Mo. The construction of this dredge with the auxiliary pipe line and pontoons was advertised November 26, 1902, proposals to be opened January 15, 1903. All bids received were rejected as being excessive, and a contract subsequently made with the New York Shipbuilding Company, the lowest bidder, for constructing the dredge only, at a cost of \$240,000, the pipe line and pontoons to be constructed separately under future advertisement.

At the end of the fiscal year all preliminary work had been completed, a berth for the dredge provided, molds and templates for the frames and hull plating well in hand; all materials for the hull is in the yard. All forgings for the machinery equipment have been ordered, and some of the patterns for the engines, etc., have been made. The detail drawings for the hull and machinery equipment are about 80 per cent completed. The contract provides for a steel, twin-screw dredge, 210 feet long over all, 198 feet between perpendiculars, 38 feet beam molded, 14 feet depth molded.

I 7.

ESTABLISHMENT OF HARBOR LINES ON THE WESTERLY SHORE OF DELAWARE RIVER BETWEEN EDMOOR AND MOUTH OF CHRISTIANA RIVER.

ENGINEER OFFICE, UNITED STATES ARMY,
Philadelphia, Pa., October 20, 1902.

GENERAL: I have the honor to invite your attention to my letter to the Chief of Engineers, dated February 9, 1901, recommending the establishment of harbor lines for the westerly shore of the Delaware River between Edgemoor and a point near the mouth of the Christiana River, and giving detailed descriptions of the lines recommended. The river and harbor bill pending at the time having failed to become a law, action was deferred by the Department, and I was instructed by Department letter dated March 9, 1901, to bring the matter to the attention of the Department when action should be thought necessary.

The project for the expenditure of the sum of \$3,000,000 available for the improvement of the Delaware River submitted by Capt. Spencer Cosby, Corps of Engineers, on July 1, 1902, and approved by Department letter dated July 7, 1902, provides for the construction of a retaining bulkhead between the mouth of Christiana River and Edgemoor behind which dredged material may be deposited and the formation of the projected channel by dredging through Cherry Island flats and from Bulkhead bar toward Philadelphia as far as funds will permit.

It is now desirable to prepare a detailed project and specifications for this work, and to this end it is necessary that the harbor lines referred to be now established. I have the honor, therefore, to recommend the establishment of harbor lines for the locality referred to as shown on the accompanying map^a and described as follows:

BULKHEAD LINE.

Beginning at a point located in the Delaware River about 162 feet from the upper outer corner of the Edgemoor Bridge Works wharf, at Edgemoor, Del., this point being called corner A, and being more particularly described hereafter; thence running S. 16° 39' 26" W. (true bearing) 9,817.33 feet to a point called corner B, more particularly described hereafter; this corner being located on or near the prolongation of the northeasterly boundary of the United States light-house reservation at the mouth of the Christiana River.

Corner A is located with reference to the triangulation system of the Delaware River survey, established by the United States Engineer Department, as follows:

Angle at station Christiana (on top of dike near Christiana light) between station Sellers (on Edgemoor Bridge Works wharf) and corner A, 1° 14' 37".

Angle at station Sellers between corner A and station Christiana, 92° 15' 22".

Distance between station Christiana and corner A, 9,843.46 feet.

Distance between station Sellers and corner A, 213.80 feet.

Corner B is located with reference to the same stations as follows:

Angle at station Christiana between station Sellers and corner B, 81° 56' 38".

Angle at station Sellers between corner B and station Christiana, 17° 34' 40".

Distance between station Christiana and corner B, 3,010.96 feet.

Distance between station Sellers and corner B, 9,871.69 feet.

PIERHEAD LINE.

Beginning at a point distant 700 feet in a direction S. 73° 20' 34" E. (true bearing), this direction being at right angles to the direction of the bulkhead line previously described, from corner A of said bulkhead line; thence running S. 16° 39' 26" W. (true bearing) parallel to and distant 700 feet from the said bulkhead line, 9,817.33 feet to a corner distant 700 feet in a direction S. 73° 20' 34" E. (true bearing) from corner B of the bulkhead line previously described.

^a Not printed.

It will be necessary to deposit material behind the bulkhead line and construct piers with great care to avoid injury to the channel. It is therefore recommended that these harbor lines be established subject to the conditions that no material shall be deposited between the bulkhead line and the present existing high-water line, except when the method, amount, time, and place of deposit are approved by the engineer officer in charge of the improvement of the Delaware River, and that piers shall not be constructed between these harbor lines before the filling is completed, unless approved and authorized by that officer.

As shown by the paper attached to the blue print^a sent herewith, most of the owners of land fronting on Delaware River between Edgemoor and the United States light-house reservation at the mouth of Christiana River, Delaware, have given their assent in writing to the establishment of the lines herein recommended. It was found impracticable to obtain the written assent of the owners of three small tracts, but these owners, it is believed, have no objection to the establishment of the lines, as is shown by letter^a from Mr. William G. Mahaffy, clerk of the United States court, at Wilmington, Del., which is sent herewith.

Very respectfully, your obedient servant,

C. W. RAYMOND,
Lieut. Col., Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 31, 1902.

Respectfully submitted to the Secretary of War.

Lieutenant-Colonel Raymond reports that in connection with the adopted project for the improvement of the Delaware River, it is desirable that harbor lines be established for the westerly shore of said river between Edgemoor and a point near the mouth of the Christiana River, and he has prepared the accompanying tracing showing proposed location of suitable lines.

Concurring in the views of the local officer, I recommend that the Secretary of War approve the bulkhead and pierhead lines described within, subject to the conditions named in paragraph 4 of the within communication.

It is further recommended that the Secretary place his approval both upon this paper and upon the accompanying tracing^a which has been prepared for his signature.

G. L. GILLESPIE,
Brig. Gen., Chief of Engineers,
U. S. Army.

[Second indorsement.]

WAR DEPARTMENT,
November 7, 1902.

Approved as recommended by the Chief of Engineers.

WM. CARY SANGER,
Assistant Secretary of War.

APPENDIX J.

IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PENNSYLVANIA, OF RIVERS AND HARBORS IN SOUTHERN NEW JERSEY, IN DELAWARE, AND IN MARYLAND EAST OF CHESAPEAKE BAY; INLAND WATERWAY FROM CHINCOTEAGUE BAY TO DELAWARE BAY, VIRGINIA, MARYLAND, AND DELAWARE.

REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1903, WITH OTHER DOCUMENTS RELATING TO THE WORKS. OFFICERS IN CHARGE, COL. JARED A. SMITH, CORPS OF ENGINEERS (NOW BRIGADIER-GENERAL, UNITED STATES ARMY, RETIRED) AND CAPT. J. C. SANFORD, CORPS OF ENGINEERS.

IMPROVEMENTS.

- | | |
|---|---|
| 1. Ice harbor at Marcushook, Pennsylvania. | 13. Elk River, Maryland. |
| 2. Rancocas River, New Jersey. | 14. Susquehanna River above and below Havre de Grace, Maryland. |
| 3. Cooper Creek, New Jersey. | 15. Rockhall, Queenstown, Claiborne, and Cam ridge harbors; Chester, Choptank, Warwick, Pocomoke, and Wicomico rivers, and Tyaskin Creek, Maryland. |
| 4. Mantua Creek, New Jersey. | 16. La Trappe River, Maryland. |
| 5. Alloway Creek, New Jersey. | 17. Nanticoke River, Delaware and Maryland. |
| 6. Goshen Creek, New Jersey. | 18. Broad Creek River, Delaware. |
| 7. Tuckerton Creek, New Jersey. | 19. Manokin River, Maryland. |
| 8. Raccoon Creek, New Jersey. | 20. Removing sunken vessels or craft obstructing or endangering navigation. |
| 9. Wilmington Harbor, Delaware. | |
| 10. Appoquinimink, Murderkill, and Mispillion rivers, Delaware. | |
| 11. Smyrna River, Delaware. | |
| 12. Inland waterway from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Delaware. | |

ENGINEER OFFICE, UNITED STATES ARMY,
Wilmington, Del., July 18, 1903.

GENERAL: I have the honor to inclose herewith annual report for the works of river and harbor improvement in this district for the fiscal year ending June 30, 1903. Col. Jared A. Smith, Corps of Engineers, was in charge to April 11, 1903, and thereafter they were in my charge.

Very respectfully, your obedient servant;

J. C. SANFORD,
Captain, Corps of Engineers.

Brig. Gen. G. L. GILLESPIE,
Chief of Engineers, U. S. A.

J 1.

IMPROVEMENT OF ICE HARBOR AT MARCUSHOOK, PENNSYLVANIA.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 166.

No work done during the past fiscal year. The expenditure is for an examination.

The protection works for this harbor consist of the old landing piers and seven detached piers having foundations of wooden cribs filled with stone, the superstructures being faced with cut stone.

Under date of April 7, 1903, the revocable license granted by the Secretary of War November 13, 1901, referred to in the Annual Report for 1902, was modified so as to permit the extension of the pier into the Delaware River a distance of 175 feet farther than originally authorized.

Money statement.

July 1, 1902, balance unexpended	\$1,715.72
June 30, 1903, amount expended during fiscal year	16.71
July 1, 1903, balance available	1,699.01

APPROPRIATIONS.

Act of—		Act of—	
June 23, 1866	\$5,000	August 5, 1886	\$15,000
March 2, 1867	94,000	August 11, 1888	15,000
January 14, 1880	35,000	September 19, 1890	5,000
March 3, 1881	30,000		
August 2, 1882	15,000	Total	214,000

J 2.

IMPROVEMENT OF RANCOCAS RIVER, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 166.

For the expenditure of the \$3,000 appropriated by the river and harbor act of June 13, 1902, a contract dated March 25, and approved April 7, 1903, has been made with the F. K. Wills Construction Company, of Wilmington, Del., for the construction of contraction works (wing dams) on the Lumberton branch of the river, the work to be completed by August 29, 1903.

Under this contract work was begun on May 11, 1903, and by the close of the fiscal year 5 wing dams of the 18 to be built had been completed and others were more or less advanced in construction, about 60 per cent of the entire work being completed.

Money statement.

July 1, 1902, balance unexpended	^a \$3,399.70
June 30, 1903, amount expended during fiscal year	352.82
July 1, 1903, balance unexpended	^a 3,046.88

^a \$399.70 pertains to Mount Holly branch.

APPROPRIATIONS.

Below the forks.

Act of—		
March 3, 1881.....	\$10,000	
August 2, 1882.....	10,000	
September 19, 1890.....	10,000	
		\$30,000

Mount Holly branch.

Act of—		
July 13, 1892.....	5,000	
August 18, 1894.....	3,000	
		8,000

Lumberton branch.

Act of—		
June 3, 1896.....	2,000	
March 3, 1899.....	2,000	
June 13, 1902.....	3,000	
		7,000
Total.....		45,000

NOTE.

Total expended to June 30, 1903.....	\$41,853.03
Carried to surplus fund in July, 1890.....	100.09
Redeposited to credit of appropriation.....	399.70

CONTRACTS IN FORCE.

Name of contractor and work: F. K. Wills Construction Company, Wilmington, Del., for construction of contraction works (wing dams) on Rancocas River, New Jersey.

Rates: For construction of wing dams, viz, posts, per foot length in place, 19 cents; piles in T head, per foot length in place, 31 cents; sheet piles, per thousand feet B. M. in place, \$48; fillers and wales, per thousand feet B. M. in place, \$48; iron, per pound in place, 4½ cents.

Date of approval: April 7, 1903.

Time of beginning work: April 30, 1903.

Time of expiration: August 29, 1903.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal.....	8,129	\$36,580
Iron, pig.....	8,800	122,320
Lime.....	5,500	27,500
Lumber.....	2,530	61,600
Manure.....	30,030	37,537
Wood.....	660	2,640
Miscellaneous.....	14,520	4,446,000
Total.....	70,169	4,734,177
Shipments:		
Clay.....	8,624	12,930
Fish.....	215	20,550
Produce.....	2,420	726,000
Sand and gravel.....	331,100	331,100
Miscellaneous.....	19,890	3,267,000
Total.....	362,249	4,357,580
Total receipts and shipments.....	432,418	9,091,757

Vessels trading in Rancocas River, New Jersey.

The steamer *Annie Van Sciver*, 400 tons, draft 7 feet, makes daily trips, and numerous lighters, barges, schooners, etc., complete statistics of which are not available, ply on the river.

J 3.

IMPROVEMENT OF COOPER CREEK, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 167.

The work done during the past year was the removal of a large tree which had fallen across the stream, blocking navigation, and the repair of the damage done to the river bank thereby.

Money statement.

July 1, 1902, balance unexpended	\$8,823.90
June 30, 1903, amount expended during fiscal year	183.62
July 1, 1903, balance available	8,640.28

APPROPRIATIONS.

Act of June 3, 1896	\$37,000.00
---------------------------	-------------

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the calendar year.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tonnage.	Number.	Tonnage.
Steamers	70	17,500	70	17,500
Sailing vessels	150	60,000	150	60,000
Barges and canal boats	1,163	290,750	1,163	290,750
Total	1,383	368,250	1,383	368,250

Freight statement.

Articles.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Asphalt	750	\$26,250
Bricks	45,167	190,580
Chemicals	8,300	66,140
Coal	204,013	625,998
Fertilizers	5,600	102,000
Grain	560	12,000
Hay	755	6,040
Iron, manufactured	337	8,500
Iron, pig	29,938	419,132
Lumber	1,502	12,965
Manure	31,200	45,300
Petroleum	4,577	81,272

Freight statement—Continued.

Articles.	Quantity.	Value.
Receipts—Continued.	<i>Tons.</i>	
Sand	166,087	\$159,427
Stone	156,786	209,639
Miscellaneous	4,939	244,772
Total	659,461	2,210,015
Shipments:		
Chemicals	14,034	274,755
Fertilizers	5,600	80,650
Iron, manufactured	2,200	305,000
Lime	450	9,000
Produce	31,000	699,000
Shells	750	7,500
Miscellaneous	13,393	121,128
Total	67,427	1,497,033

J 4.

IMPROVEMENT OF MANTUA CREEK, NEW JERSEY.

For the previous history of this improvement, see the Annual Report of the Chief of Engineers for 1903, Part I, page 168.

Contract dated March 20, and approved April 8, 1903, has been entered into with the River and Harbor Improvement Company, of Philadelphia, for dredging the channel from the Delaware River to the phosphate works to a depth of 12 feet at mean low water and a width of 100 feet at bottom, at 17 cents per cubic yard, place measurement, the work to be completed by October 31, 1903. The amount of the appropriation which remains unexpended upon the completion of the dredging will be applied to the construction of jetties, should they be found necessary for the permanent maintenance of the channel across the bar.

No work has been done during the past fiscal year. The expenditure was for examination and contingent expenses.

No reliable detailed commercial statistics have been obtained, but the tonnage is probably about 200,000, valued at about \$3,000,000 per annum.

Money statement.

July 1, 1902, balance unexpended	\$35,127.66
June 30, 1903, amount expended during fiscal year	135.99
July 1, 1903, balance unexpended	34,991.67
July 1, 1903, amount covered by uncompleted contracts	17,500.00
{ Amount (estimated) required for completion of existing project	85,030.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	30,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		
August 2, 1882		\$3,000
March 3, 1899		25,000
June 13, 1902		35,000
Total		63,000

Contracts in force.

Name of contractor.	Rate for dredging, per cubic yard, place measurement.	Date of approval.	Date of beginning work.	Date of expiration.
River and Harbor Improvement Co., Philadelphia, Pa	<i>Cents.</i> 17	Apr. 8, 1903	Apr. 21, 1903	Oct. 31, 1903

J 5.

IMPROVEMENT OF ALLOWAY CREEK, NEW JERSEY.

For the history of this improvement, see Annual Report of the Chief of Engineers for 1903, Part I, page 169.

The river and harbor act of June 13, 1902, appropriated \$3,000 for continuing this improvement, and contract dated March 20, 1903, and approved April 8, 1903, was entered into with the River and Harbor Improvement Company, of Philadelphia, for dredging in this creek, at 13 cents per cubic yard, measured in place. Under this contract work was begun on April 11 and continued to June 3, 1903, and the channel was dredged at various points between the upper end of a shoal just above Hancock Bridge and a point about 3 miles below, forming a continuous channel 6 feet deep at mean low water and 60 feet wide between the points named. The quantity of material removed is 18,019 cubic yards, measured in place, and this was deposited upon the adjacent banks.

Money statement.

July 1, 1902, balance unexpended	\$3,000.00
June 30, 1903, amount expended during fiscal year	2,689.02
July 1, 1903, balance unexpended	310.98
July 1, 1903, amount covered by uncompleted contracts	234.25
{ Amount (estimated) required for completion of existing project	8,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	8,200.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—		Act of—	
September 19, 1890	\$6,000	March 3, 1899	\$3,000
July 13, 1892	3,000	June 13, 1902	3,000
August 18, 1894	3,000		
June 3, 1896	3,000	Total	21,000

COMMERCIAL STATISTICS.

Arrivals and departures of vessels for the year ending December 31, 1902.

Kind of vessel.	Arrivals.		Departures.	
	Number.	Tonnage.	Number.	Tonnage.
Steamers.....	63	9,450	63	9,450
Sailing vessels.....	13	2,250	13	2,250
Barges and canal boats.....	54	11,250	54	11,250
Total.....	130	22,950	130	22,950

Freight statement.

Articles.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal.....	9,350	\$28,050
Glass sand.....	10,200	20,400
Lumber.....	2,550	32,300
Oyster shells.....	2,975	5,950
Soda ash.....	425	8,500
Tin plate.....	1,700	144,500
Miscellaneous.....	10,325	180,200
Total.....	37,825	419,900
Shipments:		
Canned goods.....	8,500	510,000
Glassware.....	2,125	170,000
Grain.....	2,125	34,000
Produce.....	1,275	12,750
Ship timber.....	106	2,975
Miscellaneous.....	2,125	4,250
Total.....	16,256	733,975
Total receipts and shipments.....	54,081	1,153,875

J 6.

IMPROVEMENT OF GOSHEN CREEK, NEW JERSEY.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 170.

The commerce of this creek consists of miscellaneous articles, such as sand, oysters, lime, coal, and lumber, and is principally of a local character. The value of the total freight movement for 1900 was \$438,900. No statistics have been received for 1902.

Money statement.

July 1, 1902, balance unexpended.....	\$840. 22
June 30, 1903, amount expended during fiscal year.....	68. 99
July 1, 1903, balance available.....	771. 23

APPROPRIATIONS.

Act of—	
July 13, 1892.....	\$3,000
August 18, 1894.....	3,000
June 3, 1896.....	3,000
March 3, 1899.....	8,000
Total.....	17,000

J 7.

IMPROVEMENT OF TUCKERTON CREEK, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 172.

Under date of March 26, 1903, contract was entered into with Van Sant & Boehm, of Atlantic City, N. J., for dredging under this project, at 16½ cents per cubic yard, measured in place, the work to be completed in October next. Work thereunder was begun on May 5, 1903, and continued to the end of the fiscal year, when it was still in progress. During this period the channel was dredged from a point opposite Flax Island, about 1½ miles below Tuckerton, in two cuts, upstream, making a width of 75 feet for a length of 1,555 feet and 60 feet for a further length of 550 feet, extending to a point about 300 feet above Sprague's Railway, the depth made being 4 feet at mean low water. The quantity of material removed is 14,477 cubic yards, and consists of mud, which was thrown over upon the adjacent banks.

Money statement.

July 1, 1902, balance unexpended	\$12, 000. 00
June 30, 1903, amount expended during fiscal year	1, 465. 04
July 1, 1903, balance unexpended	10, 534. 96
July 1, 1903, outstanding liabilities	1, 452. 02
July 1, 1903, balance available	9, 082. 94
July 1, 1903, amount covered by uncompleted contracts	8, 400. 00
{ Amount (estimated) required for completion of existing project	49, 380. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of June 13, 1902	\$12, 000. 00
----------------------------	---------------

Contract in force.

Name of contractor.	Rate for dredging per cubic yard, place measurement.	Date of approval.	Date of beginning work.	Date of expiration.
Van Sant & Boehm, Atlantic City, N. J.	Cents. 16½	Apr. 15, 1903	May 5, 1903	Oct. 19, 1903

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal, oysters, clams, and fish.....	11, 987	\$381, 900
Fertilizers.....	300	8, 400
Hay.....	200	1, 000
Total.....	12, 487	391, 300
Shipments:		
Cord wood, logs, etc.....	1, 235	1, 000
Lumber.....	75	2, 500
General merchandise.....	500	50, 000
Total.....	1, 810	53, 500
Total receipts and shipments.....	14, 297	444, 800

Vessels trading in Tuckerton Creek, New Jersey.

Registered at the custom-house at Tuckerton: 11 vessels above 20 tons each; 33 vessels under 20 tons each; 4 vessels used as pleasure yachts, tonnage 54.

Five gas launches, 2 feet draft, and numerous boats of different kinds, of which no statistics are obtainable, were built during the year.

Fifty sailing vessels, tonnage 250, were repaired.

The above statistics were furnished by a committee of citizens of Tuckerton, of which B. H. Crosby is secretary.

J 8.

IMPROVEMENT OF RACCOON CREEK, NEW JERSEY.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 173.

Under date of March 20, 1903, a contract was entered into with the River and Harbor Improvement Company, of Philadelphia, Pa., for the dredging that can be done with the available funds, at 15 cents per cubic yard, measured in place, the work to be completed by October 31, 1903. The work proposed under the contract is the improvement of the lower 5 miles of the creek.

During the fiscal year the creek was surveyed and the results plotted preparatory to work under the contract. The contractor's dredge arrived in the creek on June 13, but being unable to get through the draw of the railroad bridge at Bridgeton on account of its fenders, no dredging was done to June 30, 1903.

Money statement.

July 1, 1902, balance unexpended	\$15, 000. 00
June 30, 1903, amount expended during fiscal year	827. 49
July 1, 1903, balance unexpended	14, 172. 51
July 1, 1903, outstanding liabilities	24. 53
July 1, 1903, balance available	14, 147. 98
July 1, 1903, amount covered by uncompleted contracts.....	13, 500. 00
{ Amount (estimated) required for completion of existing project	87, 135. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	25, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

992 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

Act of June 13, 1902..... \$15,000

Contracts in force.

Name of contractor.	Rate for dredging per cubic yard, place measurement.	Date of approval.	Date of beginning work.	Date of expiration.
River and Harbor Improvement Co., Philadelphia, Pa.....	<i>Cents.</i> 15	Apr. 8, 1903	Apr. 21, 1903	Oct. 31, 1903

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quality.	Value.
Receipts:	<i>Tons.</i>	
Raw bone, coal, dimension stone, molding and glass sand, etc.....	33,500	\$92,600
Bricks, fertilizers, lumber, etc.....	183,050	502,500
Corn, wheat, potatoes, etc.....	14,225	46,000
Total.....	230,775	641,100
Shipments:		
Building sand.....	2,000	800
Barrels, baskets, crates, fertilizers, etc.....	6,125	115,000
Berries, fruits, poultry, potatoes, etc.....	21,400	127,000
Shad.....	800	4,000
General merchandise.....	3,000	45,000
Total.....	33,325	291,800
Total receipts and shipments.....	264,100	932,900

Vessels trading in Raccoon Creek, New Jersey.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
			<i>Feet.</i>	
Steamers.....	1	300	8	Daily during season.
Do.....	1	150	7	Do.
Steamers, small.....	7	175	4	Daily.
Do.....	1	300	8	Three trips weekly.
Tugboats.....	8	400	7	Daily.
Tow barges.....	8	1,600	5 to 6	Do.
Do.....	3	650	5 to 6	Three trips weekly.
Total.....	29	3,575		

These statistics were furnished by the Swedesboro Glass Works, Swedesboro, N. J.

IMPROVEMENT OF WILMINGTON HARBOR, DELAWARE.

For the history of this improvement see Annual Reports of the Chief of Engineers for 1901, pages 246 to 249, and for 1903, Part I, page 174.

During the year a survey was made and a project for expenditure of available funds was under consideration.

Money statement.

July 1, 1902, balance unexpended.....	\$60,654.60
Proceeds of sale of river and harbor property.....	210.00
	60,864.60
June 30, 1903, amount expended during fiscal year.....	2,938.04
July 1, 1903, balance unexpended.....	57,895.56
July 1, 1903, outstanding liabilities.....	8,000.00
	49,895.56
Amount that can be profitably expended in fiscal year ending June 30, 1906, for maintenance of improvement, in addition to the balance unexpended July 1, 1903.....	
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	
	50,000.00

APPROPRIATIONS.

Act of—		Act of—	
July 14, 1836.....	\$15,000	July 5, 1884.....	\$25,000
March 3, 1837.....	8,000	August 5, 1886.....	18,750
July 7, 1838.....	9,356	August 11, 1888.....	30,000
July 11, 1870.....	15,000	September 19, 1890.....	30,000
June 10, 1872.....	10,000	July 13, 1892.....	40,000
March 3, 1873.....	6,000	August 18, 1894.....	25,000
June 23, 1874.....	6,000	June 3, 1896.....	20,000
March 3, 1875.....	10,000	July 1, 1898.....	206,846
August 14, 1876.....	16,000	March 3, 1899.....	45,000
June 18, 1878.....	7,000	June 6, 1900.....	200,000
March 3, 1879.....	3,500	June 13, 1902.....	50,000
June 14, 1880.....	10,000		
March 3, 1881.....	50,000	Total.....	905,452
August 2, 1882.....	50,000		

NOTE.

Amount appropriated.....	\$905,452.00
Received from sale of river and harbor property.....	210.00
	\$905,662.00
Expended.....	845,355.22
Turned back into Treasury, surplus funds.....	2,411.22
Balance on hand July 1, 1903.....	57,895.56
	905,662.00

COMMERCIAL STATISTICS OF THE CITY OF WILMINGTON, DEL., FOR THE CALENDAR YEAR 1902.

[Furnished by the Wilmington Board of Trade.]

The tonnage and value of leading articles shipped to and from the port of Wilmington by water during the year 1902 are as follows:

Domestic commerce.

Articles.	Quantity.	Value.
	<i>Tons.</i>	
Coal.....	52,760	\$161,780
Cord wood.....	5,197	20,690
Quarry stone.....	106,290	250,628
Sand, building and molding, and cement.....	74,570	105,260
Ship and building timber.....	34,613	267,521
Fertilizers.....	16,100	104,790
Iron supplies and steel.....	84,541	1,569,049
Machinery.....	32,435	299,677
General merchandise.....	172,410	23,064,740
Miscellaneous.....	250,690	9,383,320
Total.....	829,606	35,227,456

Foreign commerce.

Articles.	Quantity.	Value.
Imports:		
Bone, raw.....tons..	1,000	\$5,500
Laths.....number..	2,046,100	5,000
Cornwall rock.....tons..	2,304	10,000
Nitrate of soda.....do...	5,500	172,000
Total.....		192,500
Exports:		
Barrel materials.....pieces..	65,000	3,500
Leather.....		10,000
Machinery.....		42,000
Crude petroleum.....gallons..	98,000,000	4,100,000
General merchandise.....		2,500
Total.....		4,158,000
Total foreign imports and exports.....		4,350,500

There were engaged in foreign petroleum trade to and from the port of Wilmington 21 steamers and 8 barks, of a total registered tonnage of 49,694 and drawing from 10 to 25 feet. These statistics relative to foreign commerce were furnished by the Hon. R. G. Houston, collector of the port.

Vessels trading in Wilmington Harbor not included above.

Class.	Number.	Aggregate tonnage.	Draft.
Steamers.....	5	1,670	<i>Feet.</i> 6 to 10
Tugs.....	10	540	4 to 8
Schooners.....	12	678	
Barges.....	20	9,206	
Total.....	47	12,093	

The above vessels are engaged in daily river and harbor work. There are various other vessels doing a general coastwise trade of which it is difficult to keep a correct record. The investments in freight and passenger lines between Wilmington, Del., Philadelphia, Pa., and New Jersey towns and towns on the coast would run over a million and a half dollars. There is invested in manufacturing and commercial interest on the Christiana River, all dependent upon the facilities afforded for navigation, at least \$17,500,000.

The following statistics of vessels built and repaired at Wilmington, Del., were furnished by the Harlan & Hollingsworth Company, the Pusey & Jones Company, the Jackson & Sharp Company, and Enoch Moore & Sons Company.

Vessels built.

Class.	Number.	Aggregate tonnage.	Draft when leaving shipyard.
Steamer, steel.....	1	1,810.15	<i>Ft. In.</i> 9
Ferryboat.....	1	709.14	10 41
Do.....	1	1,016.82	11 84
Auxiliary schooner yacht.....	1	246	16 21
River steamer.....	1	742	
Do.....	1	871.29	5 84
Pleasure yacht.....	1	217	11 6
Passenger and freight steamer.....	1	285	7 44
Do.....	1	288	5 84
Side-wheel steamer.....	1	652	6 8
Barges, wooden.....	2	525	
Tank barge, wooden.....	1	500	9
Steamer, wooden.....	1	220	9 6
Lighters, wooden.....	4	1,350	
Car floats, wooden.....	4	2,300	
Total.....	22	11,232.40	

Vessels repaired.

Class.	Number.	Aggregate tonnage.
Steamers.....		29,400
Do.....	5	1,580
Do.....	29	88,281
Total tonnage of steamers.....		69,211
Barges.....	4	3,770
Lighters.....	13	
Sailing vessels.....		7,500
Do.....	7	3,064
Do.....	4	5,026
Total tonnage of sailing vessels.....		19,350
Grand total.....		88,561

J 10.**IMPROVEMENT OF APPOQUINIMINK, MURDERKILL, AND MISPELLION RIVERS, DELAWARE.****(A) APPOQUINIMINK RIVER.**

For previous history, see Annual Report of the Chief of Engineers for 1903, Part I, page 175.

The river and harbor act of June 13, 1902, appropriated \$15,000 for the Appoquinimink, Murderkill, and Mispillion rivers, for maintenance; and of this amount, \$3,000 was allotted to this improvement and applied to dredging.

After due advertisement contract dated September 18, 1902, was made with the Atlas Dredging Company for dredging in this river, at 14 cents per cubic yard, place measurement, and work thereunder was begun on December 9, 1902, and to the close of the work, on January 31, 1903, various shoals in the river were dredged to a width of about 80 feet and the cut-off at Toms Bay was widened to 50 feet, the aggregate length dredged being 2,800 feet, resulting in a clear channel depth of between 7 and 8 feet at mean low water and a width of between 50 and 100 feet, except at a place just beyond Townsends Point, where the depth is but 6 feet at mean low water. The material removed consisted mainly of stiff and soft mud and matted roots. Some sand was dredged at Townsends Point. The quantity removed was 17,510 cubic yards. It was placed ashore, above the high-water line.

Money statement.

July 1, 1902, balance unexpended	\$87. 93
Amount allotted from amount appropriated by river and harbor act of June 13, 1902.....	3, 000. 00
	3, 087. 93
June 30, 1903, amount expended during fiscal year	2, 867. 12
July 1, 1903, balance unexpended	220. 81
Amount (estimated) required for completion of existing project.....	14, 963. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$14, 963. 00
For maintenance of improvement	1, 200. 00
	16, 163. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
September 19, 1890	\$5,000	March 3, 1899	\$5,000
July 13, 1892	5,000	June 13, 1902 (allotment)	3,000
August 18, 1894	5,000		
June 3, 1896	5,000	Total	28,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal	1,850	\$14,800
Fertilizers, etc.	4,850	72,500
Potatoes, flour, etc.	250	7,500
General merchandise	6,275	564,750
Total	13,225	659,550
Shipments:		
Canned goods, etc.	1,750	168,000
Agricultural products, poultry, sheep, etc.	14,825	868,500
Fish	195	19,500
General merchandise	850	76,500
Total	17,620	1,127,500
Total receipts and shipments	30,845	1,787,050

Vessels trading in Appoquinimink River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
Steamer	1	136	<i>Fect.</i> 7	Triweekly trips 8 months of the year, then semiweekly, carrying general merchandise. Transient. Grain, etc.
Schooners	2	150	6	
Total	3	286		

Also other vessels, from time to time, of which no record has been kept.
The above statistics were furnished by F. B. Watkins, Odessa, Del.

(b) MURDERKILL RIVER.

The previous history of this improvement is contained in the Annual Report of the Chief of Engineers for 1903, Part I, page 176.

The river and harbor act of June 13, 1902, appropriated \$15,000 for the Appoquinimink, Murderkill, and Mispillion rivers, for maintenance, and of this amount \$2,000 was allotted to the Murderkill River. After due advertisement, contract dated September 18, 1902, was made with the lowest bidder, the Atlas Dredging Company, of Wilmington, Del., for dredging at 13 cents per cubic yard, place measurement, and work thereon was begun on November 20, 1902, at the head of West Canal, in the upper part of the river. At this point a shoal was dredged, and work carried on downstream removing

shoals at Goodwins, Coles shoals, above and below Webb's landing, and at Sand Point at the mouth of the river, the length of dredging aggregating 2,130 feet. The width made was from 30 to 40 feet, and the minimum depth 7 feet at mean low water. The quantity of material removed was 13,782 cubic yards, measured in place, and consisted of mud and sand in the river, and sand and oyster shells at the mouth. This was deposited on the adjacent banks above the high-water line.

Money statement.

July 1, 1902, balance unexpended	\$139. 22
Amount allotted from amount appropriated by river and harbor act of June 13, 1903	2, 000. 00
	<u>2, 139. 22</u>
June 30, 1903, amount expended during fiscal year	2, 023. 22
July 1, 1903, balance unexpended	<u>116. 00</u>
Amount (estimated) required for completion of existing project	27, 764. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	15, 000. 00
For maintenance of improvement	1, 500. 00
	<u>16, 500. 00</u>
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
July 13, 1892	\$7, 000	June 13, 1902 (allotment) ...	\$2, 000
August 18, 1894	^a 6, 500		
June 3, 1896	6, 500	Total	27, 000
March 3, 1899	5, 000		

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal, phosphate rock, ice, etc.	8, 300	\$30, 900
Fertilizers, flour, sawed lumber, etc.	6, 000	328, 200
Agricultural products, horses, etc.	300	86, 600
General merchandise	300	60, 000
Total	8, 900	455, 700
Shipments:		
Barrels, baskets, canned goods, carriages, etc.	1, 538	86, 700
Agricultural products, sheep, poultry, etc.	10, 615	290, 250
General merchandise	300	55, 000
Total	12, 353	431, 950
Total receipts and shipments	21, 253	887, 650

^aOf this amount \$1,500 was expended in removing shoal at mouth of St. Jones River.

Vessels trading in Murderkill River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
Steamer	1	100	<i>Fect.</i> 5½	Semiweekly. General merchandise.

There are about 20 vessels sailing in and out of the Murderkill River for grain, oysters, and general freight, whose names are not known. Draft, about 5 feet.

The foregoing statistics were furnished by J. W. Townsend, secretary, Philadelphia and Frederica Steamboat Company, Frederica, Del.

(C) MISPELLION RIVER.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 178.

The river and harbor act of June 13, 1902, appropriated \$15,000 for the Appoquinimink, Murderkill, and Mispillion rivers, for maintenance. Of this amount \$10,000 was allotted to this improvement. The project approved for its expenditure provides for dredging at the mouth of the river and the construction of a jetty on the northeasterly side of the channel across the bar. The dredging was done first.

After due advertisement contract dated September 18, 1902, was made with the lowest bidders, the Atlas Dredging Company, of Wilmington, Del., at 16 cents per cubic yard, measured in place. Work thereunder was begun on October 16, and continued to November 3, 1902. During this period the channel across the flats was dredged for a length of 4,450 feet from a point 1,100 feet out from the outer end of the Green Point jetty along the former cut, about a south-southeast course from the light-house. The depth made was 5 feet at mean low water and the width 40 feet. The quantity of material removed is 23,383.8 cubic yards, place measurement, of which 11,215.9 cubic yards was charged to the Government, the excess representing width dredged beyond that required by the specifications. The material, which consisted of mud and quicksand, was thrown over along the south side of the cut at a distance of about 63 feet from the center of the 40-foot cut, making it fully 70 feet from the center of the 25-foot channel contemplated by the specifications. Owing to the character of the material, much of the dredged sand and mud washed back into the channel, as soundings taken upon the completion of the dredging showed the average depth throughout the distance dredged to be about 4 feet.

Under date of April 10, 1903, contract was entered into with Benjamin T. Collins, the lowest bidder, for the construction of the jetty across the bar, and work thereunder was begun on May 21, 1903, but has progressed slowly, owing to the breaking of the contractor's machinery and other causes. To the close of the fiscal year a total of 720 linear feet of piling had been driven.

Money statement.

July 1, 1902, balance unexpended	\$161.95
Amount allotted from amount appropriated by river and harbor act of June 13, 1902	10,000.00
	10,161.95
June 30, 1903, amount expended during fiscal year	2,366.97
July 1, 1903, balance unexpended	7,794.98
July 1, 1903, amount covered by uncompleted contracts	7,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2,500.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Previous projects.

Act of—	
March 3, 1879	\$3,000
June 14, 1880	4,000
March 3, 1881	3,500
August 2, 1882	3,000
August 11, 1888	3,500
	\$17,000

Project of 1891.

Act of—	
July 13, 1892	12,000
August 18, 1894	10,000
March 3, 1899	2,500
June 6, 1900 (allotment)	1,050
June 13, 1902 (allotment)	10,000
	35,550
Total	52,550

NOTE.

Expended to June 30, 1903	44,727.34
June 30, 1902, redeposited to credit of appropriation for emergencies in river and harbor work, act of June 6, 1900	27.68

CONTRACT IN FORCE.

Name of contractor and work: Benjamin T. Collins, Milford, Del., for construction of jetty at mouth of Mispillion River, Delaware.

Rates: Brush placed in jetty, \$3 per cord; stone placed in jetty, \$3 per cubic yard; piles placed in jetty, 15 cents per linear foot; sawed timber placed in jetty, \$40 per thousand feet, board measure; bolts and washers in jetty, 4 cents per pound.

Date of approval: April 27, 1903.

Time of beginning work: May 10, 1903.

Time of expiration: September 10, 1903.

1000 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	Tons.	
Raw bone, rock phosphate, etc.....	13, 950	\$117, 400
Chemicals, flour, fertilizers, etc.....	3, 895	81, 740
Hay, fruit, grain, etc.....	572	42, 300
General merchandise.....	5, 000	\$25, 000
Total.....	23, 417	566, 440
Shipments:		
Railroad ties, timber, logs, etc.....	8, 600	53, 000
Canned goods, lumber, fertilizers, etc.....	14, 275	658, 400
Grain, fruit, poultry, etc.....	10, 548	287, 500
General merchandise.....	500	20, 000
Total.....	33, 923	998, 900
Total receipts and shipments.....	57, 340	1, 565, 340

Vessels trading in Mispillion River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Trips.
Steamer.....	1	130	<i>Feet.</i> 5½	Semiweekly: during first season triweekly. These vessels trade regularly, carrying fertilizers, phosphate, railroad ties, etc., and general merchandise.
Schooners.....	14	1, 600	5½ to 7½	
Total.....	15	1, 730	.....	

One barge, 2 yachts, 2 schooners, and 1 tugboat, aggregate tonnage 960, and draft 3½ to 5½ feet, built, and 2 schooners and 20 sailing vessels, aggregating 2,175 tons, repaired during the year.

The above statistics were collected by C. M. Stevenson, inspector, United States engineer department.

J II.

IMPROVEMENT OF SMYRNA RIVER, DELAWARE.

For previous history see Annual Report of the Chief of Engineers for 1903, Part I, page 179.

No work of improvement has been done in the past fiscal year. The expenditure was for examination of river.

Money statement.

July 1, 1902, balance unexpended.....	\$15, 252. 46
June 30, 1903, amount expended during fiscal year.....	236. 39
July 1, 1903, balance unexpended.....	15, 016. 07
{ Amount (estimated) required for completion of existing project.....	4, 365. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$4, 365. 00
For maintenance of improvement.....	1, 500. 00
	5, 865. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Project of 1878.

Act of—

June 14, 1880	\$5, 000
March 3, 1881	3, 000
August 2, 1882	2, 000
	\$10, 000

Project of 1887.

Act of—

August 11, 1888	10, 000
September 19, 1890	5, 000
July 13, 1892	3, 000
August 18, 1894	5, 000
June 3, 1896	5, 000
March 3, 1899	5, 000
June 13, 1902	15, 000
	48, 000
Total	58, 000

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Bone, iron ore, steel, etc	7, 375	\$115, 469
Canned goods, flour, millwork, etc	10, 028	316, 000
Cattle, grain, horses, sheep, fertilizers, etc	53, 632	496, 000
General merchandise	10, 000	200, 000
Total	81, 035	1, 127, 469
Shipments:		
Railroad ties, ship timber, etc	47, 617	209, 000
Canned goods, fertilizers, terra cotta, etc	266, 080	813, 000
Fruit, grain, cattle, poultry, etc	23, 564	1, 066, 000
General merchandise	12, 000	240, 000
Total	349, 261	2, 328, 000
Total receipts and shipments	430, 236	3, 455, 469

Vessels trading in Smyrna River, Delaware.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
Steamers	1	125	<i>Fect.</i> 6	Daily round trip 3 months: remainder of year 3 round trips weekly.

Also tugs *Jansen*, *Laura B*, *Morgan*, and other tugs with floats and barges carrying lime, phosphate, wood, ties, etc.

The above statistics were furnished by A. E. Jardine, secretary Smyrna River Transportation and Manufacturing Company.

J 12.

IMPROVEMENT OF INLAND WATERWAY FROM CHINCOTEAGUE BAY, VIRGINIA, TO DELAWARE BAY, AT OR NEAR LEWES, DELAWARE.

For the previous history of this improvement and of work done see Annual Reports of the Chief of Engineers for 1885, pages 891 to 914; 1892, pages 956 to 965, and 1903, Part I, page 180.

The contract made on April 7, 1902, with Samuel H. Lea and Julian C. Smith provides for the construction of two parallel jetties of stone and brush, each about 700 feet long, extending out from the shore at the entrance to the canal leading northward from Rehoboth Bay, and for dredging to a depth of 6 feet below Rehoboth Bay level between a point just below the railroad crossing at Rehoboth and Whites Creek, Delaware, the work to be completed by October 31, 1902. This time was extended, the work under the contract not being begun until September 16, 1902. To the end of the fiscal year the jetties had been completed and the canal north of Rehoboth Bay had been dredged where required, and some dredging done in Rehoboth Bay at the mouth of the canal. The quantity of material removed is 9,229 cubic yards, scow measurement, and consisted almost wholly of sand. This was deposited in Rehoboth Bay in places designated by the Department.

No statistics as to commerce have been obtained. A small steamer has recently begun to ply between the railroad crossing at Rehoboth and Bethany Beach.

Money statement.

July 1, 1902, balance unexpended.....	\$25,328.12
June 30, 1903, amount expended during fiscal year.....	17,889.50
July 1, 1903, balance unexpended.....	7,438.62
July 1, 1903, outstanding liabilities.....	253.81
July 1, 1903, balance available.....	7,184.81
July 1, 1903, amount covered by uncompleted contracts.....	6,600.00
{ Amount (estimated) required for completion of existing project.....	^a 181,250.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	100,000.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Act of—	Act of—
August 5, 1886..... \$18,750	August 18, 1894..... \$25,000
August 11, 1888..... 50,000	June 3, 1896..... 25,000
September 19, 1890..... 50,000	
July 13, 1892..... 25,000	Total..... 193,750

^a Exclusive of \$37,343.58, award for right of way through Delaware, Maryland and Virginia Railroad.

CONTRACTS IN FORCE.

Name of contractor and work: Samuel H. Lea and Julian C. Smith, New York, N. Y., for dredging and jetty construction on inland waterway from Chincoteague Bay, Virginia, to Delaware Bay at or near Lewes, Del.

Rates: For dredging and jetty construction, viz: Brush mattresses, in place, \$1.55 per square yard; small stone, in place, \$3.15 per ton of 2,000 pounds; large stone, placed, \$3.30 per ton of 2,000 pounds; excavating, removing, and depositing sand or hard clay, 35 cents per cubic yard, scow measurement; excavating, removing, and depositing mud and soil, 33 cents per cubic yard, scow measurement.

Date of approval: April 16, 1902.

Time of beginning work: May 1, 1902.

Time of expiration: October 31, 1902; this has been extended.

J 13.

IMPROVEMENT OF ELK RIVER, MARYLAND.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 182.

Proposals for the required dredging were duly advertised for and contract dated December 3 and approved December 30, 1902, made with the lowest bidder, the American Paving and Construction Company of Philadelphia, at 19 cents per cubic yard, measured in scows. Work thereunder on this river was begun December 23, 1902, and continued to May 9, 1903. The channel was dredged to a depth of 8 feet at mean low water from a point about 30 feet below the bridge at Elkton to Cedar Point, a distance of about 5,500 feet. Of this distance a length of 2,000 feet at the upper end was dredged to the full width of 100 feet, the next 1,200 feet below to a width of 80 feet, and the remaining 2,300 feet 60 feet. The project width of 100 feet could not be made, as the channel was found to have shoaled very much since the survey in 1899, on which the appropriation for the present improvement was based. To complete the project will require the removal of about 40,000 cubic yards of material. The quantity of material removed is 75,110.8 cubic yards, and consisted of sand and clay, with some gravel. It was placed on the marshes along the river above high water and behind banks thrown up in former dredging, except about 9,700 yards scowed away and deposited some 2 miles below Cedar Point, well out of the channel, in 3 to 4 feet of water.

Money statement.

July 1, 1902, balance unexpended	\$16,665.00
June 30, 1903, amount expended during fiscal year.....	15,064.33
July 1, 1903, balance unexpended	1,600.67
(Amount (estimated) required for completion of existing project.....	1,427.11
Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903	2,500.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

1004 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

By act approved—		By act approved—	
June 23, 1874	\$5,000	September 19, 1890	\$10,000
March 3, 1875	5,000	July 13, 1892	5,000
June 14, 1880	10,000	June 13, 1902	16,665
March 3, 1881	5,000		
By act of August 2, 1882.....	6,500	Total	63,165

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Cord wood, etc.	11,340	\$40,960
Phosphate rock	2,773	18,024
Fertilizer materials, including potash, salts, etc.	1,305	26,100
Total	15,418	85,074
Shipments:		
Fertilizers	1,971	31,536
Total receipts and shipments	17,389	116,610

* The total amount of cord wood received at the pulp works was 11,500 cords, all of which would have been taken by water, but on account of shoaling in the river 5,200 cords had to be taken by rail at increased cost.

VESSELS SAILING.

There were 125 arrivals of steamers, tugs, schooners, sloops, and barges, carrying wood and fertilizers during the year, the draft of the vessels varying from 4 to 8½ feet.

VESSELS BUILT.

Twenty-two barges and other vessels, of the value of \$102,000, built during the year, the average tonnage of the barges being 900 tons.

The above statistics were furnished by W. H. MacKall, vice-president of the Scott Fertilizer Company, Elkton, Md.

J 14.

IMPROVEMENT OF SUSQUEHANNA RIVER ABOVE AND BELOW HAVRE DE GRACE, MARYLAND.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 183.

A survey of the river has been made during the past fiscal year, extending from 5 miles below Spesutia Island to Port Deposit, and report thereon submitted under date of February 19, 1903. It recommended the removal of a small amount of rock a short distance from the wharves at Port Deposit and the dredging of the point of shoal opposite Watsons Island to a depth of 8 feet, as far as available funds appropriated in former years would permit; and for dredging the channel to a depth of 15 feet at mean low water from a point near Havre de Grace light-house, past Fishers Battery light-house to head of Spesutia Island, the width not to exceed 200 feet, with the \$10,000 appropriated last year.

Proposals for this work have been invited, and it is expected to be completed the coming fall.

It has been impracticable to obtain complete commercial statistics, but it is reported that there are annually 150 to 200 boats of various kinds, carrying 75,000 to 100,000 tons of quarried stone and phosphate rock, using the Susquehanna River at and below Port Deposit.

Money statement.

July 1, 1902, balance unexpended	\$19, 734. 05
June 30, 1903, amount expended during fiscal year	1, 132. 01
July 1, 1903, balance unexpended	18, 602. 04
{ Amount (estimated) required for completion of existing project	84, 500. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	20, 000. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act approved—	
August 30, 1852	\$10, 000
June 23, 1866	26, 400
July 25, 1868 (allotment)	5, 000
April 10, 1869 (allotment)	990
July 11, 1870	12, 000
June 14, 1880	28, 000
March 3, 1881	15, 000
	\$97. 390
By act passed August 2, 1882	25, 000
By act approved—	
July 5, 1884	20, 000
August 5, 1886	6, 000
By act of August 11, 1888	10, 000
By act approved—	
September 19, 1890	4, 000
July 13, 1892	4, 000
1879, allotment from general appropriation for examinations and surveys	500
By act of—	
August 18, 1894	4, 000
June 13, 1902	10, 000
	83, 500
Aggregate	180, 890

J 15.

IMPROVEMENT OF HARBORS AT ROCKHALL, QUEENSTOWN, CLAI-BORNE, AND CAMBRIDGE; AND OF CHESTER, CHOPTANK, WARWICK, POCOMOKE, AND WICOMICO RIVERS, AND TYASKIN CREEK, MARYLAND.

(A) ROCKHALL HARBOR AND INNER HARBOR AT ROCKHALL.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 184.

1006 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Contract, dated December 3 and approved December 30, 1902, for dredging this and the other improvements on the easterly shore of Chesapeake Bay has been made with the American Paving and Construction Company, of Philadelphia, at 19 cents per cubic yard, scow measurement, the entire work to be completed by December 31, 1903.

No work has been done on this improvement during the past fiscal year. The expenditure was for an examination and contingent expenses.

Money statement.

July 1, 1902, balance unexpended	\$12,000.00
June 30, 1903, amount unexpended during fiscal year.....	150.19
July 1, 1903, balance unexpended	11,849.81
July 1, 1903, amount covered by uncompleted contracts.....	10,800.00
{ Amount (estimated) required for completion of existing project.....	48,655.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$12,000.00
For maintenance of improvement.....	8,320.00
	20,320.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—	
June 3, 1896	\$16,600
June 13, 1902 (allotment).....	12,000
Total.....	28,600

CONTRACTS IN FORCE.

For contract for dredging at Rockhall Harbor and other Eastern Shore improvements see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR 1902.

ROCKHALL, KENT COUNTY, MD., June 17, 1903.

DEAR SIR: I send you the following commercial statistics for Rockhall:

* * * * *

From 50 to 60 vessels (sloops and schooners), of from 5 to 50 tons, make Rockhall their headquarters. Swan Point bar is one of the largest and most prolific oyster bars in the State, and a large number of persons are engaged in catching oysters and shipping them away, chiefly to Baltimore. At present two steamboats, *Gratitude* and *B. S. Ford*, touch at Rockhall, each making the round trip daily. The *B. S. Ford* carries excursions between Baltimore and Rockhall and Chester River. Two sailing packets run regularly between Rockhall and Baltimore, carrying freight and a few passengers.

During the oyster season a number of "bumboats" carrying oysters run regularly between Rockhall and Baltimore. During the past few years the town of Rockhall and surrounding country have become the resort of large numbers of summer boarders. This is a new business for the people of the locality, and is increasing all the time, and has increased largely the passenger business of the steamboats.

The estimated value of oysters, fish, and crabs shipped from Rockhall is \$150,000. Large quantities of grain, fruit, and other agricultural products are shipped from this locality to Baltimore, but the exact amount I am unable to estimate at present.

General merchandise shipped to Rockhall, \$251,975; lumber, \$33,000; bricks, \$2,260; fertilizers, \$19,560; coal, \$18,000.

* * * * *

Yours, truly, JOSEPH DOWNEY.

Capt. J. C. SANFORD, U. S. Army.

(B) QUEENSTOWN HARBOR.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 185.

For the expenditure of the allotment, contract dated December 3 and approved December 30, 1902, has been made with the American Paving and Construction Company, of Philadelphia, for dredging, at 19 cents per cubic yard, scow measurement, and it is proposed to dredge the entire length of channel to a depth of 10 feet and as wide as practicable within the project limits. By the close of the fiscal year a length of about 740 feet in the outer section of the channel leading to Queenstown Harbor, from the 10-foot curve in Chester River, had been dredged to a width of 100 feet, and two additional cuts, inward, of an aggregate length of 1,080 feet, had been dredged to a width of 30 feet, the depth made being 10 feet at mean low water. The quantity of material removed is 27,368 cubic yards, consisting mainly of fine, hard sand. This was scowed away and deposited in Chester River under Hail Point in about 60 feet of water.

Money statement.

July 1, 1902, balance unexpended	\$12,000. 00
June 30, 1903, amount expended during fiscal year	2,012. 52
July 1, 1903, balance unexpended	9,987. 48
July 1, 1903, outstanding liabilities	3,605. 53
July 1, 1903, balance available	6,381. 95
July 1, 1903, amount covered by uncompleted contracts	4,500. 00
{ Amount (estimated) required for completion of existing project	11,100. 00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903	11,100. 00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

By act approved—	
March 3, 1871	\$5,000
June 10, 1872	6,000
March 3, 1879	3,000
June 3, 1896	5,000
Act of June 13, 1902 (allotment)	12,000
Total	31,000

1008 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

CONTRACTS IN FORCE.

For contract for dredging at Queenstown Harbor and other Eastern Shore improvements see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Traffic.

	Tons.
Per steamers of Queen Anne's Railroad Company	9,358
Per Chester River Steamboat Company	3,811
Per 2 vessels, 37 and 44 ton size, respectively, carrying wheat, corn, and general merchandise	5,600
Total	18,769

Vessels trading in Queenstown Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
			<i>Feet.</i>	
Steamer	1	436	9	Twice a day.
Do.	1	410	6	Do.
Do.	1	553	5	Daily trips; June to January twice daily.
Do.	1	417	5	Substitute steamer.
Do.	1	214	7½	Do.
Do.	1	368	6	6 to 10 times a year.
Schooners	2	81	6	Average of 40 trips a year.
Total	8	2,479		

These statistics have been furnished by the Chester River Steamboat Company and Queen Anne's Railroad Company.

(C) CLAIBORNE HARBOR.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 185.

It is proposed to apply the allotment to dredging the channel to a depth of 12 feet and as wide, within the project limits, as the available funds will permit; and a contract, dated December 3 and approved December 30, 1902, has been made with the American Paving and Construction Company, of Philadelphia, for dredging this and other eastern shore improvements, at 19 cents per cubic yard, scow measurement, the entire work to be completed by December 31, 1903.

No work was done on this improvement during the past fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$15,000.00
June 30, 1903, amount expended during fiscal year	68.50
July 1, 1903, balance unexpended	14,931.50
July 1, 1903, amount covered by uncompleted contracts	13,500.00
(Amount (estimated) required for completion of existing project	2,490.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$2,490.00
For maintenance of improvement	1,000.00
	3,490.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of June 13, 1902 (allotment)..... \$15,000.00

CONTRACTS IN FORCE.

For contract for dredging at Claiborne Harbor and other eastern shore improvements see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Total receipts and shipments.

General merchandise	tons..	75,000
Coal	do.	10,000
Lumber and ties	feet..	225,000
United States mail	tons..	60
Passengers	number..	82,630

Vessels sailing and trading in Claiborne Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			<i>Feet.</i>	<i>Feet.</i>
Steamers	2	1,510	7	7
Sailing vessels and barges	50	3,000	4	10

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

(D) CAMBRIDGE HARBOR.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 186.

It is proposed to extend the 8-foot channel inside of the drawbridge, the width to be 150 feet, and the work is covered by a contract, dated December 3 and approved December 30, 1902, with the American Paving and Construction Company, of Philadelphia, for dredging this and other improvements, at 19 cents per cubic yard, scow measurement, the entire work to be completed by December 31, 1903.

No work has been done during the past fiscal year. The expenditure was for an examination.

Money statement.

July 1, 1902, balance unexpended	\$3,000.00
June 30, 1903, amount expended during fiscal year	64.50
July 1, 1903, balance unexpended	2,935.50
July 1, 1903, amount covered by uncompleted contracts	2,700.00
Amount (estimated) required for completion of existing project	5,120.00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$5,120.00
For maintenance of improvement	1,200.00
	6,320.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

1010 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

APPROPRIATIONS.

By act approved—		By act approved—	
March 3, 1871	\$10, 000	September 19, 1890	\$5, 000
June 10, 1872	10, 000	July 13, 1892	7, 737
March 3, 1873	5, 000	Act of June 13, 1902 (allotment)	3, 000
June 18, 1878	5, 000		
March 3, 1879	2, 500	Total	53, 237
By act of August 11, 1888	5, 000		

CONTRACTS IN FORCE.

For contract for dredging at Cambridge Harbor and other eastern shore improvements, see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
<i>Receipts:</i>	<i>Tons.</i>	
Coal, dimension stone, ice, etc	203	\$2, 400
Fertilizers, flour, millwork, etc	73, 708	838, 696
Cattle, hogs, horses, etc	1, 262	90, 100
General merchandise	3, 000	120, 000
Total	78, 168	1, 051, 196
<i>Shipments:</i>		
Canned goods, crates, lumber, etc	1, 618	93, 690
Fruit, grain, eggs, poultry, etc	3, 286	94, 067
General merchandise	2, 919	116, 760
Total	7, 823	304, 517
Total receipts and shipments	85, 991	1, 355, 713

Vessels sailing and trading in Cambridge Harbor, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			<i>Feet.</i>	<i>Feet.</i>
Steamers	6	2, 461	5	9
Sailing vessels and barges	98	2, 500	4	12

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

(e) CHESTER RIVER.

For history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 187.

After due advertisement contract dated December 3 and approved December 30, 1902, was made with the lowest bidder, the American Paving and Construction Company, of Philadelphia, at 19 cents per

cubic yard, measured in scows, and dredging under this contract was begun on this river on January 7, 1903, at a point about 50 feet below the point where dredging was suspended under the previous contract in 1899 and carried up to Jones Landing, a distance of 2,480 feet, the depth made being 6 feet at mean low water and the width 60 feet. The upper end for a distance of about 200 feet was made fan shape, to serve as a turning basin, the width at Jones Landing being 120 feet. Upon completion of this work a serious shoal which had formed at Stony bar since the last dredging was done there was dredged to a width of 30 feet and a depth of 6 feet at mean low water for a distance of about 500 feet. The quantity of material removed is 23,907 cubic yards, scow measurement, and consisted of sand, gravel, and mud, but mainly sand. This was deposited upon the adjoining flats and banks of the river. Further dredging was suspended on March 20, 1903. Upon the conclusion of these operations an examination was made and the channel heretofore dredged was found to have a depth of from 5 to 6 feet at mean low water and a width of from 45 to 60 feet, except the shoal at Stony bar, referred to above, where the width is but 30 feet.

Money statement.

July 1, 1902, balance unexpended	\$5, 622. 74
June 30, 1903, amount expended during fiscal year	5, 157. 04
July 1, 1903, balance unexpended	465. 70
July 1, 1903, amount covered by uncompleted contracts.....	465. 23
(Amount (estimated) required for completion of existing project	2, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$2, 500. 00
For maintenance of improvement.....	1, 500. 00
	4, 000. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Act of—		Act of—	
September 19, 1890	\$5, 000	March 3, 1899.....	\$3, 200
July 13, 1892.....	3, 000	June 13, 1902 (allotment)....	5, 402
August 18, 1894.....	1, 500		
June 3, 1896.....	1, 500	Total	19, 602

CONTRACTS IN FORCE.

For contract for dredging at Chester River and other eastern shore improvements see under Tyaskin Creek, page 1019.

1012 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Wool, oysters, fish, and crabs	2,934	\$183,360
Canned goods.....	1,088	62,150
Cattle, horses, mules, sheep, etc	5,000	510,750
Fruit, berries, etc.....	15,657	445,667
General merchandise.....	6,911	207,330
Total.....	31,590	1,409,257
Shipments:		
Fertilizers, flour, sawed lumber, etc.....	4,329	115,212
Hay.....	240	720
General merchandise.....	11,353	334,110
Total.....	15,922	450,042
Total receipts and shipments.....	47,512	1,859,299

Vessels trading in Chester River, Maryland.

Class.	Number.	Aggregate tonnage.	Draft.	Remarks.
			<i>Fect.</i>	
Steamer	1	553	6	Daily except Sunday for about 6 months, and then triweekly. General merchandise.
Do.....	1	417	6	
Do.....	1	214	8½	
Do.....	1	368	8	
Total	4	1,552		Daily except Sunday for about 3 months, tri-weekly about 4 months, and remainder of year irregular.

These statistics were furnished by the Chester River Steamboat Company and relate to the business of that company alone. Small sailing craft also ply in the river.

(F) CHOPTANK RIVER.

For the previous history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, p. 187.

Under a contract dated December 3, 1902, made with the American Paving and Construction Company, of Philadelphia, for dredging at this and other improvements on the easterly shore of Chesapeake Bay, at 19 cents per cubic yard, scow measurement, dredging was commenced at this place on June 2 and continued to the 18th, 1903, during which time shoals at various points between Greensboro and Denton were dredged to a depth of 8 feet at mean low water and a width of about 50 feet, removing 10,927.6 cubic yards of sand, gravel, and clay, which was deposited upon the adjacent banks. At the conclusion of the operations an examination showed that the channel generally has shoaled to a depth of about 7 feet at mean low water and narrowed to between 40 and 60 feet.

Money statement.

July 1, 1902, balance unexpended	\$3,098. 48
June 30, 1903, amount expended during fiscal year	2,437. 39
July 1, 1903, balance unexpended	661. 09
July 1, 1903, amount covered by uncompleted contracts.....	228. 39
(Amount (estimated) required for completion of existing project	7,430. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$7,430. 00
For maintenance of improvement.....	1,500. 00
	8,930. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act approved—		By act approved July 13, 1892...	\$3,000
June 14, 1880	\$5,000	By act of August 18, 1894	2,000
March 3, 1881	5,000	By act of June 3, 1896	2,000
By act of August 2, 1882	5,000	By act approved March 3, 1899..	8,000
By act approved—		By act of June 13, 1902 (allot-	
July 5, 1884.....	5,000	ment)	3,000
August 5, 1886.....	10,000		
By act of August 11, 1888.....	7,500	Total	63,000
By act approved September 19,			
1890.....	7,500		

CONTRACTS IN FORCE.

For contract for dredging at Choptank River and other eastern shore improvements see under Tyaskin Creek, p. 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Iron, coal, phosphate rock, oysters, fish, etc	4,574	\$23,892
Canned goods, fertilizers, etc	115,735	1,656,867
Horses, sheep, etc	2,713	182,611
General merchandise	9,956	597,300
Total	132,977	2,460,670
Shipments:		
Quarry stone, timber, railroad ties, etc	1,149	6,050
Canned goods, lumber, flour, etc	5,857	265,757
Fruit, grain, cattle, etc	25,032	691,724
General merchandise	7,788	263,780
Total	39,826	1,227,311
Total receipts and shipments.....	172,803	3,687,981

1014 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Vessels sailing and trading in Choptank River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
Steamers.....	6	2,461	<i>Fct.</i> 5	<i>Fct.</i> 9
Sailing vessels and barges	224	5,900	4	12

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

(G) WARWICK RIVER.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 188.

Under a contract dated December 3, 1902, made with the American Paving and Construction Company, of Philadelphia, for dredging at this and other improvements on the easterly shore of Chesapeake Bay, at 19 cents per cubic yard, scow measurement, work will probably begin at this place in the course of a few days. No work has been done during the past fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$4,000.00
June 30, 1903, amount expended during fiscal year	4.50
July 1, 1903, balance unexpended	3,995.50
July 1, 1903, amount covered by uncompleted contracts	3,600.00
{ Amount (estimated) required for completion of existing project	2,600.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$2,600.00
For maintenance of improvement	1,000.00
	3,600.00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

Previous project.

By act approved—	
June 14, 1880	\$3,000
March 3, 1881	3,000
	\$6,000

Present project.

By act of—	
July 13, 1892	6,000
August 18, 1894	2,000
June 3, 1896	2,000
March 3, 1899	2,000
June 13, 1902 (allotment)	4,000
	16,000
Total both projects	22,000

CONTRACTS IN FORCE.

For contract for dredging at Warwick River and other eastern shore improvements see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Fish, oysters, coal, etc.....	1,004	\$4,549
Flour, fertilizers, furniture, chemicals, etc.....	2,854	96,978
Cattle, horses, etc.....	1,520	71,961
General merchandise.....	917	55,044
Total	6,295	227,532
Shipments:		
Canned goods, lumber, etc.....	1,075	52,261
Fruit, wheat, poultry, sheep, etc.....	49,351	859,683
General merchandise.....	1,349	66,066
Total	51,775	978,010
Total receipts and shipments.....	58,070	1,206,542

Vessels sailing and trading in Warwick River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			<i>Feet.</i>	<i>Feet.</i>
Steamers.....	6	2,461	5	9
Sailing vessels and barges	50	1,200	4	8

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

(H) POCOMOKE RIVER, BELOW SNOW HILL.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 189.

Under a contract dated December 3, 1902, made with the American Paving and Construction Company, of Philadelphia, for dredging at this and other improvements on the easterly shore of Chesapeake Bay, at 19 cents per cubic yard, scow measurement, it is proposed to use the allotment made in widening the channel previously dredged, and where shoals have formed to obtain a depth of 9 feet at mean low water. This work is to be completed by December 31, 1903.

1016 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Money statement.

July 1, 1902, balance unexpended	\$4, 800. 00
June 30, 1903, amount expended during fiscal year	4. 20
July 1, 1903, balance unexpended	4, 795. 70
July 1, 1903, amount covered by uncompleted contracts	4, 300. 00
(Amount (estimated) required for completion of existing project	1, 200. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$1, 200. 00
For maintenance of improvement.....	1, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	2, 700. 00

APPROPRIATIONS.

By act approved—		
June 18, 1878.....	\$10, 000	
March 3, 1879.....	2, 500	
August 5, 1886.....	8, 000	
		\$20, 500
By act of June 3, 1896.....	5, 000	
By act approved March 3, 1899.....	3, 000	
By act approved June 13, 1902 (allotment).....	4, 800	
		12, 800
Aggregate		33, 300

CONTRACTS IN FORCE.

For contract for dredging at Pocomoke River, and other eastern shore improvements, see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal, dimension stone, ice, etc.....	310	\$1. 97
Fertilizers, flour, mill work, etc.....	4, 873	326. 65
Cattle, hogs, horses, etc.....	894	25. 60
General merchandise.....	11, 000	660. 00
Total.....	17, 077	1, 014. 31
Shipments:		
Cord wood, logs, ship timber, etc.....	3, 311	39. 12
Canned goods, crates, lumber, etc.....	21, 681	236. 14
Fruit, grain, eggs, poultry, etc.....	5, 664	119. 91
Total.....	30, 656	396. 18
Total receipts and shipments.....	47, 733	1, 409. 50

Vessels sailing and trading in Pocomoke River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
Steamers.....	2	1,527	<i>Feet.</i> 4	<i>Feet.</i> 6½
Sailing vessels and barges	71	4,800	4	7

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

(1) WICOMICO RIVER.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 189.

A contract dated December 3 and approved December 30, 1902, has been made with the American Paving and Construction Company, of Philadelphia, for dredging on this and the other eastern shore improvements, at 19 cents per cubic yard, scow measurement, the entire work covered by the contract to be completed by December 31, 1903. No work has been done on the river during the past fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$6,800.00
June 30, 1903, amount expended during fiscal year	49.33
July 1, 1903, balance unexpended	6,750.67
July 1, 1903, amount covered by uncompleted contracts.....	6,000.00

APPROPRIATIONS.

Act of—	
June 10, 1872.....	\$5,000
March 3, 1873.....	5,000
June 28, 1874.....	5,000
March 3, 1875.....	5,000
August 14, 1876.....	5,000
June 18, 1878.....	5,000
March 3, 1879.....	3,000
June 14, 1880.....	5,000
March 3, 1881.....	2,000
July 5, 1884.....	10,000
	\$50,000
September 19, 1890.....	10,000
July 13, 1892.....	6,500
August 18, 1894.....	3,000
June 3, 1896.....	3,700
June 13, 1902 (alloment)	6,798
	29,998
Aggregate	79,998

1018 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

CONTRACTS IN FORCE.

For contract for dredging at Wicomico River and other eastern shore improvements, see under Tyaskin Creek, page 1019.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Bone, phosphate rock, oysters, etc.....	3,556	\$66,604
Fertilizers, flour, dressed lumber, etc.....	89,450	1,392,508
Horses, hay, etc.....	418	33,325
General merchandise.....	13,451	687,084
Total.....	106,875	2,179,521
Shipments:		
Coal, wood, etc.....	9,550	20,200
Canned goods, fertilizers, bricks, etc.....	15,898	249,606
Corn, wheat, fruit, etc.....	4,138	174,299
General merchandise.....	31,765	1,306,980
Total.....	61,351	1,750,034
Total receipts and shipments.....	168,226	3,929,555

Vessels sailing and trading in Wicomico River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
Steamers.....	2	1,548	<i>Fect.</i> 5	<i>Fect.</i> 6½
Sailing vessels and barges.....	18	2,600	5	9

Forty-seven schooners and sloops, aggregate tonnage 1,400, repaired during the year. A large four-master, to sail from Salisbury, is under construction.

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company, and the Hon. E. Stanley Toadvin, of Salisbury, Md.

(J) TYASKIN CREEK.

For the history of this improvement, see the Annual Report of the Chief of Engineers for 1903, Part I, page 190.

Contract dated December 3 and approved December 30, 1902, has been made with the American Paving and Construction Company, of Philadelphia, Pa., for dredging this and other improvements on the eastern shore of Chesapeake Bay, Maryland, at 19 cents per cubic yard, scow measurement, the entire work to be completed by December 31, 1903. No work has been done on this creek during the past fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$8,000.00
June 30, 1903, amount expended during fiscal year	9.20
July 1, 1903, balance unexpended	7,990.80
July 1, 1903, amount covered by uncompleted contracts.....	7,200.00
{ Amount (estimated) required for completion of existing project.....	5,200.00
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903.....	5,200.00
{ Submitted in compliance with requirements of sundry civil act of June 4, 1897.	

APPROPRIATIONS.

Allotment from act of June 13, 1902 \$8,000

Contracts in force.

Name of contractor.	Rate for dredging, per cubic yard, scow measurement. ^a	Date of approval.	Date of beginning work.	Date of expiration.
American Paving and Construction Company, Philadelphia, Pa	<i>Cents.</i> 19	Dec. 30, 1902	Jan. 11, 1903	Dec. 31, 1903

^aIncludes harbors at Rockhall, Queenstown, Claiborne, and Cambridge, and Chester, Choptank, Warwick, Pocomoke and Wicomico rivers, and Tyaskin Creek.

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Phosphate rock	20	\$221
Fertilizers, canned goods, flour, etc	228	6,226
Corn, wheat, and horses	16	235
General merchandise	160	6,400
Total	424	13,082
Shipments:		
Lumber, crates, etc	3	132
Fruit, grain, etc	262	16,285
General merchandise	24	960
Total	289	17,377
Total receipts and shipments	713	30,459

Vessels sailing and trading in Tyaskin Creek, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
Steamers	3	1,727	<i>Fert.</i> 4	<i>Fect.</i> 6½
Sailing vessels and barges	20	1,500	4	6

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

J 16.

IMPROVEMENT OF LA TRAPPE RIVER, MARYLAND.

For the history of this improvement see Annual Report of the Chief of Engineers for 1903, Part I, page 191.

No work has been done on this improvement during the past fiscal year.

1020 REPORT OF THE CHIEF OF ENGINEERS, U. S. ARMY.

Money statement.

July 1, 1902, balance unexpended	\$36. 13
July 1, 1903, balance unexpended	36. 13
(Amount (estimated) required for completion of existing project.....	2, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement.....	\$2, 500. 00
For maintenance of improvement	1, 000. 00
	3, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act approved—	
July 13, 1892.....	\$2, 500
August 18, 1894	4, 750
Total	7, 250

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Coal, phosphate rock, etc.....	2, 612	\$7, 397
Canned goods, flour, shingles, etc.....	1, 903	26, 850
Fruit, fertilizers, etc.....	282	11, 000
General merchandise.....	2, 277	187, 500
Total.....	7, 074	181, 747
Shipments:		
Logs, ship timber, ties, etc.....	83	275
Fertilizers, lumber, canned goods, etc.....	652	26, 554
Grain, poultry, sheep, etc.....	3, 366	84, 854
General merchandise.....	66	1, 100
Total.....	4, 167	112, 783
Total receipts and shipments.....	11, 241	294, 530

Vessels sailing and trading in La Trappe River, Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
			<i>Feet.</i>	<i>Feet.</i>
Steamers.....	3	923	6	9
Sailing vessels and barges.....	70	2, 005	4	9

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

J 17.

IMPROVEMENT OF NANTICOKE RIVER, DELAWARE AND MARYLAND.

For previous history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 192.

An examination of the channel was made in July, 1902, and the expenditure is on that account.

No work has been done during the past fiscal year.

Money statement.

July 1, 1902, balance unexpended	\$786. 50
June 30, 1903, amount expended during fiscal year	50. 00
July 1, 1903, balance unexpended	736. 50
{ Amount that can be profitably expended in fiscal year ending June 30, 1905, for maintenance of improvement, in addition to the balance unexpended July 1, 1903 Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899. 2,500. 00	

APPROPRIATIONS.

By act of August 18, 1894	^a \$5,000
By act of June 3, 1896	3,000
By act approved March 3, 1899	3,000
Total	11,000

COMMERCIAL STATISTICS FOR CALENDAR YEAR ENDING DECEMBER 31, 1902.

Receipts and shipments.

Class.	Quantity.	Value.
Receipts:	<i>Tons.</i>	
Raw bone, phosphates, ship timber, etc	423	\$8,725
Fertilizers, flour, lumber, etc	82,840	503,230
Cattle, horses, hay, etc	700	33,473
General merchandise	1,375	82,500
Total	85,338	627,928
Shipments:		
Canned goods, basket and barrel material, etc	3,110	146,025
Berries, peaches, grain, poultry, etc	6,446	278,751
General merchandise	1,320	79,200
Total	10,876	503,976
Total receipts and shipments	96,214	1,181,904

^a See note to appropriations for Broad Creek River, Delaware.

Vessels sailing and trading in Nanticoke River, Delaware and Maryland.

Class.	Number.	Aggregate tonnage.	Light draft.	Loaded draft.
Steamers.....	3	1,727	<i>Fed.</i> 4	<i>Fed.</i> 6½
Sailing vessels and barges.....	75	11,050	4	12

The above statistics were furnished by Willard Thomson, vice-president and general manager of the Baltimore, Chesapeake and Atlantic Railway Company.

J 18.

IMPROVEMENT OF BROAD CREEK RIVER, DELAWARE.

For the history of this improvement see the Annual Report of the Chief of Engineers for 1903, Part I, page 192.

No work was done on the improvement during the past year. The expenditure was for an examination.

It has been impracticable to obtain complete commercial statistics.

Money statement.

July 1, 1902, balance unexpended	\$374. 80
June 30, 1903, amount expended during fiscal year	50. 00
July 1, 1903, balance unexpended	324. 80

APPROPRIATIONS.

By act approved—		By act approved July 13, 1892... \$5,000
June 14, 1880.....	\$5,000	By act of August 18, 1894..... ^a 5,000
March 3, 1881.....	10,000	By act of June 3, 1896..... 5,000
By act of August 2, 1882.....	5,000	By act approved March 3, 1899.. 5,000
By act approved August 5, 1886..	10,000	
By act of August 11, 1888.....	5,000	Total, present project..... 20,000
Total	35,000	Aggregate..... 55,000

J 19.

IMPROVEMENT OF MANOKIN RIVER, MARYLAND.

For previous history see the Annual Report of the Chief of Engineers for 1903, Part I, page 193.

No work has been done on this improvement during the past year. The expenditure was for an examination.

It was impracticable to obtain complete commercial statistics, but it is reported that the commerce has increased between 5 and 10 per

^a This appropriation was applied to removing bar on Nanticoke River, under the terms of the appropriation.

cent over that reported for 1896, which was 32,076 tons, valued at \$522,990.

Money statement.

July 1, 1902, balance unexpended	\$115. 03
June 30, 1903, amount expended during fiscal year	50. 00
July 1, 1903, balance unexpended	65. 03
Amount (estimated) required for completion of existing project	7, 500. 00
Amount that can be profitably expended in fiscal year ending June 30, 1905, in addition to the balance unexpended July 1, 1903:	
For works of improvement	\$7, 500. 00
For maintenance of improvement	4, 000. 00
	11, 500. 00
Submitted in compliance with requirements of sundry civil act of June 4, 1897, and of section 7 of the river and harbor act of 1899.	

APPROPRIATIONS.

By act approved—	
September 19, 1890	\$7, 500
July 13, 1892	7, 500
Act of August 18, 1894	4, 000
Act of June 3, 1896	4, 000
Act of March 3, 1899	1, 500
Total	24, 500

J 20.

REMOVING SUNKEN VESSELS OR CRAFT OBSTRUCTING OR ENDANGERING NAVIGATION.

[In charge of Col. Jared A. Smith, Corps of Engineers, to April 11, 1903, and thereafter under Capt. J. C. Sanford, Corps of Engineers.]

Canal boat Ida May, in Rancocas River, New Jersey.—At the close of the fiscal year 1902 bids received for the removal of this wreck were under consideration. The bid of Louis H. Darling, of Philadelphia, who offered to remove the wreck for \$289 was accepted. Operations were begun July 14, 1902, and completed on the 18th of the same month. The total cost, including inspection, etc., was \$370.11.

Schooner Elsie M. Harris, off Green Run Inlet life-saving station, coast of Maryland.—The examination of this wreck, which had been ordered toward the close of the fiscal year 1902, was made at a cost of \$50, and the wreck found to be lying about 1½ miles E. N. E. ½ E., magnetic, from Green Run Inlet life-saving station, and a dangerous obstruction to small coastwise vessels. Contract dated September 12, 1902, was made with Van Sant & Boehm, of Atlantic City, N. J., the lowest bidders, who offered to remove the wreck for \$350. The work of removal was begun on September 18, 1902, and completed on the 25th of the same month. The cost, including inspection, etc., was \$429.28.

Schooner Van Sciver and sloop Nettie, lying sunk in Little Creek, Delaware.—The examination of these wrecks, which had been ordered toward the close of the fiscal year 1902, was made at a cost of \$20, and

^a Of this amount \$2,000 is for work in the upper river not covered by project.

the wrecks found to be obstructions to navigation, as they closed up the channel to Dover Landing, which is the place for the shipment of grain in that district. Contract dated November 24, 1902, was made with the lowest bidders, the Atlas Dredging Company, of Wilmington, Del., who offered to remove the wrecks for \$250. Work of removal was begun on November 28 and completed December 13, 1902. The cost, including inspection, etc., was \$381.43.

Scow in Cooper Creek, New Jersey.—This wreck slid down from its moorings into the channel, near Browning Landing, and completely blocked navigation in the upper part of the creek. Award was made to the lowest bidder, John Thomas, of Merchantville, N. J., who offered to remove the wreck for \$225. Operations for the removal were begun September 11 and completed September 15, 1902. The cost, including inspection, etc., was \$284.87.

Barge Henry C., in Cohansey Creek, New Jersey.—This barge, laden with coal, broke away from her moorings on September 28, 1902, and drifted down to the Commerce Street Bridge, where she sank, completely blocking navigation through the bridge. An examination was made, and it was found that the owners and others interested in getting the wreck out of the way were engaged in its removal. By October 20, 1902, the wreck had been removed sufficiently to reopen navigation. The cost of the examination of this wreck by the Department was \$40. In February, 1903, complaint was made that a part of the hull which had not been removed had shifted into the channel, seriously obstructing navigation. This was found to be the case, and contract dated March 11, 1903, was made with the lowest bidder, John L. Grim, of Philadelphia, who offered to remove all that remained of the wreck in the creek for \$490. The work of removal was begun April 13, and completed April 16, 1903. Owing to its proximity to the bridge, the wreck was removed by a clam-shell dredge, as the use of explosives could not be safely permitted. The cost, including inspection, etc., was \$601.18.

Fishing schooners Addie Thatcher and Little Myro, lying sunk in Deals Island Harbor, Maryland.—An examination of these wrecks was made on October 9, 1902. They were not considered such obstructions to navigation as are contemplated by law, and their removal at the expense of the United States was therefore not recommended. The cost of the examination was \$25.

Sloop Three Brothers, lying sunk near Baxter's wharf, on the Schuylkill River, Pennsylvania.—This was sunk on October 9, 1902, while unloading hay at the wharf, and at the time of the examination was lying 150 feet south of the ship channel and not an obstruction to navigation, but interfered with access to Baxter's wharf only. It was not considered such an obstruction to navigation as is contemplated by law. No expense was involved in the examination.

English iron hull steamer Amy Dora, at Wachapreague Inlet, Virginia; English steel hull steamer Sutton, at Fenwicks Island shoal, Maryland; Spanish iron hull steamer Uriarte No. 4, off Popes Island, Virginia; English steamer Oakdene, off Chincoteague light-house, Virginia, and schooner Elsie M. Harris.—A petition signed by Capt. Henry Hilton, master and owner of the *Theodore Fletcher*, and others, to the Secretary of War asked for the removal of these wrecks as dangerous to vessels plying up and down the coast. The sum of \$200 having been allotted to cover the expense, an examination was made

on October 9 to 11, 1902. The *Amy Dora* was found lying in 18 feet of water at low tide on the easterly edge of Dawson shoal, about 2½ miles east southeast of Wachapreague Inlet life-saving station, Virginia. Her length was 260 feet, width 34 feet, depth of hold 24 feet 4 inches. This vessel was sunk October 5, 1889. The bow and stern were about 1 foot below low water, the midship portion being flattened down. The wreck was considered a dangerous obstruction to navigation; two vessels are reported to have been sunk by it, and several others damaged by collision with it. The cost of removal was estimated at \$4,000.

The *Sutton* was found lying about 6.1 miles east of Fenwicks Island light in 26 feet of water. Her length is 314 feet, breadth 44.1 feet, and depth of hold 20.7 feet. A small portion of the frame could be seen at low water. This wreck was considered dangerous to vessels navigating the coast in foggy or thick weather. The cost of removal was estimated at \$7,000.

Steamer *Uriarte No. 4* was found lying in 24 feet of water, on the edge of Winter Quarter shoal, about 7 miles offshore nearly abreast of Popes Island life-saving station, Winter Quarter light-ship bearing ESE. ¼ E. about 3.2 miles. She was sunk July 10, 1901. Her length is 285 feet, breadth 38.4 feet, and depth of hold 19.3 feet. The wreck was considered dangerous to navigation in thick weather. The cost of removal was estimated at \$6,000.

Steamer Oakdene.—This vessel was wrecked March 7, 1895, bearing from light-house given as east by north, distant about 1 mile from shore. A careful search was made, but no trace of the wreck could be found. The captain of the life-saving station stated that parties said to be from Baltimore had been working at this wreck during last summer recovering iron and brass, and that he thought it had been pretty thoroughly torn up. The location of the wreck was stated to be too far inshore to interfere with navigation.

Schooner Elsie M. Harris.—This wreck has just been removed. (See above.)

In view of the foregoing the Secretary of War, under date of November 3, 1902, approved a recommendation of the Chief of Engineers that the removal of the wrecks of the *Amy Dora*, *Sutton*, and *Uriarte No. 4* be authorized, and that an additional allotment of \$500 be made for a further examination, advertising, etc., with a view to securing a more definite estimate of the cost of their removal, deferring the final allotment to cover the complete expense until proposals shall have been obtained.

A further examination of the wrecks was made on April 28, 29, and 30, 1903, and proposals for the removal of the wrecks opened, the lowest bids being, respectively, as follows:

<i>Amy Dora</i> , Van Sant & Boehm, Atlantic City, N. J.....	\$8, 900
<i>Sutton</i> , Charles W. Johnston, Lewes, Del	9, 500
<i>Uriarte No. 4</i> , Charles W. Johnston, Lewes, Del	11, 300
Total	27, 700

The matter was submitted to the Department under date of June 24, 1903, and at the close of the fiscal year no final action had been taken. The amount expended to June 30, 1903, is \$562.48.

Schooner Jas. K. Burnite, lying in *Leipsic River*, Delaware.—It was reported by Dr. E. J. Stout, of Philadelphia, that one William Bar-

nett had scuttled this schooner on the banks of Leipsic River, causing an obstruction to navigation. The wreck was found on the bank, but not scuttled. Barnett promised to remove it, but a recent examination shows but little of it removed, and indications that the work of removal has been abandoned. As it does not appear to be such an obstruction to navigation as is contemplated by law, a recommendation has been made that no further action be taken by the Department in the matter. The cost of the examination was \$26.86.

Four-masted schooner R. & T. Hargraves, lying sunk in 6½ fathoms of water SE. by E. ¼ E. of Tucker Beach light-house, New Jersey, 3 miles distant.—As this location is directly in the path of vessels engaged in the coastwise trade it was considered a dangerous obstruction to navigation. Contract dated May 6, 1903, made with the lowest bidders, Van Sant & Boehm, of Atlantic City, for the removal of the obstructive parts of the wreck to a depth of 5 fathoms at low water for \$1,812. Work was begun on June 3 and completed on June 19, 1903. The cost of the work, including inspection, etc., was \$2,123.26.

INDEX.

[The references in roman are to part and those in arabic to page. The letter "S" indicates the supplement.]

A.

- Academy Creek, Ga. (*see* Brunswick Harbor)..... i, 267; ii, 1164
- Acts of Fifty-seventh Congress, second session, affecting Corps of Engineers. iv, 2943
- Acushnet River, Mass.:
 - Harbor lines at New Bedford and Fairhaven..... i, 640, 820
 - Improvement of New Bedford Harbor i, 92, 794
- Agate Bay, Minn., improvement of harbor i, 465; ii, 1793
- Agawam, Mass., South End Bridge across Connecticut River to Springfield.. i, 652
- Ahnapee Harbor, Wis., improvement of i, 480; ii, 1847
- Alabama and Mississippi Railroad Company, bridge of..... i, 645
- Alabama River, Ala., improvement of i, 302; ii, 1228
- Alameda, Cal.:
 - Bridge across San Leandro Bay to Bay Farm Island i, 646
 - Improvement of Oakland Harbor..... i, 582; iii, 2186
- Alameda County, Cal., bridge of i, 646
- Albany, N. Y.:
 - Harbor lines in Hudson River..... i, 640, 901
 - Removal of wreck in Hudson River i, 139, 888
- Albemarle and Chesapeake Canal, N. C., waterway via i, 226; ii, 1084
- Albemarle Sound, N. C.:
 - Improvement of waterway to Norfolk, Va., via Currituck Sound.. i, 226; ii, 1084
 - Improvement of waterway to Norfolk, Va., via Pasquotank River. i, 226; ii, 1083
 - Removal of wreck in..... i, 228; ii, 1088
- Alert (canal boat), removal of wreck of..... i, 139, 887
- Alexandria, La.:
 - Bridge across Red River to Pineville (Alexandria and Pineville Bridge Co.)..... i, 644
 - Bridge across Red River to Pineville (Shreveport and Red River Valley Rwy. Co.)..... i, 643
- Alexandria and Pineville Bridge Company, bridge of..... i, 644
- Allegheny, Pa.:
 - See also* Pittsburg Harbor.
 - Bridge across Allegheny River to Pittsburg (Union Bridge) i, 651
 - Bridge across Ohio River to borough of McKees Rocks..... i, 644
- Allegheny River, Pa.:
 - Bridge at Brilliant Station, Pittsburg i, 649
 - Bridge near Franklin (Big Rock Bridge) i, 651
 - Bridge at Franklin (county bridge) i, 651
 - Bridge at Herr Island, Pittsburg i, 649
 - Bridge at Kennerdell..... i, 647
 - Bridge between Pittsburg and Allegheny (Union Bridge)..... i, 651
 - Construction of locks and dams..... i, 438; ii, 1680
 - Harbor lines at Pittsburg i, 640; ii, 1706, 1709
 - Improvement by open-channel work i, 439; ii, 1686
 - Improvement of Pittsburg Harbor i, 432; ii, 1667
 - Operating and care of Herr Island dam i, 439; ii, 1683
- Allouez Bay, Wis. (*see* Duluth Harbor) i, 466; ii, 1794
- Alloway Creek, N. J., improvement of i, 169, 988
- Alpena Harbor, Mich., improvement of i, 523; iii, 1985
- Altamaha River, Ga., improvement of..... i, 264; ii, 1158

- Alva, Fla., bridge across Caloosahatchee River at Ferry Crossing..... I, 647
- Alviso Harbor, Cal., improvement of I, 580; III, 2181
- Ambrose channel, New York Harbor, N. Y., improvement of, including dredge construction..... I, 139, 909, 975
- Amite River, La., improvement of..... I, 338; II, 1305
- Amy, Dora (steamer), removal of wreck of I, 194, 1624
- Anacostia River, D. C.:
 Improvement of..... I, 200; II, 1040
 Survey of United States land within flats of..... I, 36
- Anclote River, Fla., improvement of..... I, 287; II, 1202
- Andura (Nandua) Creek, Va., improvement of..... I, 207; II, 1054
- Ann, Cape, Mass.:
 Construction of harbor of refuge, with report relative to completion of project I, 62, 740, 742
 Improvement of Rockport Harbor..... I, 64, 743
- Anoka, Minn., bridge across Mississippi River..... I, 643
- Apalachicola Bay and River, Fla.:
 Improvement of bay..... I, 291; II, 1209
 Improvement of river, including the Cut-off I, 292; II, 1212
 Removal of wreck at Apalachicola I, 306; II, 1236
- Appleton, Wis.:
 See also Fox River.
 Bridge across Fox River I, 646
- Appomattox River, Va., improvement of..... I, 223; II, 1080
- Appoquinimink River, Del., improvement of I, 175, 995
- Appropriations:
 Fortifications I, 10, 14, 17
 Rivers and harbors I, 35, 36
- Aqueduct Bridge, Washington, D. C., repair of..... I, 652; IV, 2493
- Aqueduct, Washington, D. C. *See* Washington.
- Aquia Creek, Va., improvement of..... I, 207; II, 1055
- Aransas Pass, Tex., improvement of..... I, 359; II, 1345
- Aransas Pass Harbor Company (*see* Aransas Pass) I, 359; II, 1345
- Arcata, Cal. (*see* Humboldt Harbor) I, 591; III, 2199
- Arch rock, San Francisco Harbor, Cal., removal of I, 582; III, 2184
- Arkansas River:
 Bridge between Arkansas and Desha counties, Ark..... I, 643
 Bridge near Fort Gibson, Ind. T..... I, 642
 Gauging (*see* Mississippi River Commission) I, 639; S., 7, 8, 62, 97
 Improvement of..... I, 376; II, 1407
- Armament. *See* Fortifications.
- Army War College, Washington, D. C., buildings for..... I, 674; IV, 2931
- Arthur Kill, N. Y. and N. J.:
 Improvement of..... I, 147, 932
 Recommendation for stone monuments to mark established harbor lines..... I, 141
 Removal of wrecks I, 158, 159, 955, 956
- Arthur Lake, La. (*see* Mermentau River) I, 340; II, 1308
- Ashpoo River, S. C., waterway via, with estimates of cost I, 255; II, 1132
- Ashland, Ky.:
 See also Ohio River.
 Bridge across Ohio River to Ironton, Ohio I, 644
- Ashland and Ironton Bridge Company, bridge of I, 644
- Ashland Harbor, Wis., improvement of..... I, 469; II, 1811
- Ashley River, S. C., removal of wreck I, 257; II, 1140
- Ashtabula Harbor, Ohio, improvement of, including dredge construction..... I, 553, 979; III, 2093
- Assawaman Bay, Del., waterway via..... I, 180, 1002
- Assistants:
 Civilian, to engineer officers..... I, 23
 On duty in Office of the Chief of Engineers I, 676
- Astoria, Oreg. (*see* Columbia River below Tongue Point) I, 614; III, 2270
- Atchafalaya Basin levee board of Louisiana, lock and dam in Bayou Lafourche I, 641
- Atchafalaya River, La.:
 Gauging (*see* Mississippi River Commission) I, 639; S., 7, 8, 62, 97
 Rectification of mouth by Mississippi River Commission I, 639; S., 3, 40
- Atchison, Topeka and Santa Fe Railway Company, bridge of I, 647

Atlantic City, N. J., bridges across Beach Thoroughfare and Lakes Ditch.....	i, 647, 648
Atlantic City, Va., harbor lines in Norfolk Harbor at	i, 640; ii, 1089
Atlantic County, N. J.:	
Bridges of, across Lakes Ditch and Beach Thoroughfare	i, 648
Bridge of, across Patcong Creek.....	i, 651
Atlantic (South) States, removal of water hyacinths from Florida waters, including report on experiments made	i, 279; ii, 1184; iv, 2433
Attorney-General, reports by:	
On modification of bridges impeding navigation of Ohio River.....	i, 37
On title to lands embraced within flats of Anacostia River, D. C.....	i, 36
Aux Becs Scies Lake, Mich. (<i>see</i> Frankfort Harbor).....	i, 518; iii, 1975

B.

Babson, Harriet W. (schooner), removal of wreck of	i, 53, 727
Back Bay of Biloxi, Miss. (<i>see</i> Biloxi Harbor)	i, 319; ii, 1264
Back Cove, Portland, Me. (<i>see</i> Portland)	i, 51, 725
Back River, Md., bridge across.....	i, 649
Back River, Mass. <i>See</i> Weymouth River.	
Badger, Horace H. (schooner), removal of wreck of.....	i, 556; iii, 2105
Bad River, Mich., improvement of	i, 525; iii, 1986
Bagaduce River, Me., improvement of	i, 42, 716
Ballard, Wash.:	
Improvement of Puget Sound-Lake Washington waterway	i, 629; iii, 2332
Reexamination of Puget Sound-Lake Washington waterway, with plans and estimates of cost.....	i, 630; iii, 2340
Baltimore Harbor, Md.:	
Bridge at Spring Garden.....	i, 649
Defenses of, including report on damp-proofing	i, 9; iv, 2400
Harbor lines in Patapsco River at Sparrow Point.....	i, 640; ii, 1033
Improvement at Spring Garden.....	i, 197; ii, 1031
Improvement of channel to	i, 194; ii, 1027
Improvement of channel to Curtis Bay	i, 196; ii, 1031
Revised estimate of cost of increasing depth of channel to.....	i, 195; ii, 1032
Baltimore (steamer), removal of wreck of	i, 324; ii, 1272
Bangor Harbor, Me. (<i>see</i> Penobscot River)	i, 43, 717
Barge No. 3, removal of wreck of, in Buffalo Bayou, Tex.....	i, 360, 361; ii, 1347
Bar Harbor, Me.:	
Construction of breakwater	i, 39, 714
Defenses of, including report on telephone booths and damp-proof- ing.....	i, 9; iv, 2371
Barracks, Washington, D. C.....	i, 17, 19, 23, 674, 675, 683; iv, 2934
Barren River, Ky., operating and care of lock and dam	i, 461; ii, 1776
Bartholomew Bayou, La. and Ark., improvement of.....	i, 368, 370; ii, 1379
Bass Rip, Mass., removal of wrecks	i, 104, 820
Battalions of Engineers.....	i, 5, 18, 669, 686; iv, 2906
Batteries, gun and mortar.....	i, 9, 14, 17
Battery, the, New York, N. Y., removal of shoal in North River, off Pier A.	i, 140, 911
Bayboro, N. C., bridge across Bay River.....	i, 652
Bay Farm Island, Oakland Harbor, Cal., bridge across San Leandro Bay....	i, 646
Bayonne, N. J., removal of wreck in Newark Bay	i, 159, 955
Bay Ridge channel, New York Harbor, N. Y., improvement of	i, 142, 915
Bay River, N. C., bridge at Bayboro	i, 652
Bayside channel, New York Harbor, N. Y., improvement of.....	i, 139, 909
Beach Thoroughfare, N. J., bridges at Atlantic City	i, 647, 648
Beaufort Harbor, N. C.:	
Improvement of	i, 236; ii, 1102
Improvement of waterway to Newbern	i, 235; ii, 1101
Improvement of waterway to New River.....	i, 236; ii, 1103
Beaufort Harbor and River, S. C.:	
Defenses of Port Royal Sound, including report on damp-proofing	i, 9; iv, 2409
Improvement of river.....	i, 256; ii, 1139
Improvement of waterway to Charleston, S. C.....	i, 255; ii, 1138
Improvement of waterway to Savannah (<i>see</i> Savannah Harbor).....	i, 257; ii, 1141
Removal of logs from waterway to Charleston, S. C.....	i, 257; ii, 1140
Beautiful Island, Caloosahatchee River, Fla., bridge at	i, 649
Beechridge, Ill., prevention of break in Mississippi River at.....	i, 392; ii, 1455

- Belle River, Mich., improvement of I, 531; III, 19
 Bellingham Bay, Wash. *See* New Whatcom Harbor.
 Benton Harbor, Mich., improvement of St. Joseph Harbor I, 501; III, 19
 Benton Harbor Canal, Mich. (*see* St. Joseph Harbor) I, 501; III, 19
 Bergen Point, N. J., removal of wreck in Newark Bay opposite I, 158, 9
 Bergen Point reef, Newark Bay, N. J., removal of wreck on I, 158, 9
 Berrian Island, East River, N. Y., harbor lines I, 640, 1
 Beverly Harbor, Mass., improvement of I, 68, 7
 Big Assawaman Bay, Del., waterway via I, 180, 10
 Big Barren River, Ky., operating and care of lock and dam I, 461; II, 17
 Big Hocking River, Ohio, ice harbor in Ohio River near I, 423; II, 16
 Big Rock Bridge Company, bridge of I, 6
 Big Sandy Railway Company, bridge of I, 6
 Big Sandy River, W. Va. and Ky.:
 Bridge across Levisa Fork at Whitehouse, Ky. I, 6
 Improvement of, including Tug and Levisa forks I, 448; II, 17
 Operating and care of lock and dam I, 450; II, 17
 Big Sarasota Bay, Fla., improvement of I, 284; II, 11
 Big Sioux River, S. Dak., ice harbor at Sioux City, Iowa I, 406; II, 15
 Big Stone Lake, Minn., survey of I, 404; II, 15
 Big Sunflower River, Miss., improvement of I, 373; II, 13
 Biloxi Harbor, Miss., improvement of I, 319; II, 12
 Bird, Harry E. (barge), removal of wreck of I, 165, 9
 Biscayne Bay, Fla., improvement of I, 277; II, 11
 Bismarck Harbor, N. Dak. (*see* Missouri River) I, 405; II, 15
 Black Lake, Mich., improvement of Holland Harbor I, 506; III, 19
 Black River, Ark. and Mo., improvement of I, 384; II, 14
 Black River, La., improvement of I, 366; II, 13
 Black River, Mich.:
 Improvement at mouth I, 527; III, 19
 Improvement at Port Huron I, 529; III, 19
 Black River, N. C.:
 Bridge at Still Bluff I, 6
 Improvement of I, 233; II, 11
 Black River, Ohio:
 Bridge at Lorain I, 6
 Improvement of Lorain Harbor I, 547; III, 20
 Black River, Wash., bridge in King County I, 6
 Black Rock Harbor, Conn. (*see* Bridgeport Harbor) I, 115, 8
 Black Rock Harbor, N. Y.:
 Improvement of Buffalo entrance to I, 562; III, 21
 Improvement of Lake Erie entrance to I, 562; III, 21
 Black Warrior River, Ala.:
 Improvement above Tuscaloosa I, 309; II, 12
 Improvement below Tuscaloosa I, 309; II, 12
 Operating and care of locks and dams I, 315; II, 1253, 12
 Removal of wreck I, 324; II, 12
 Blaine, James G. (schooner), removal of wreck of I, 103, 8
 Block Island, R. I.:
 Construction of harbor of refuge I, 101, 8
 Improvement of Great Salt Pond I, 102, 8
 Blood River, La. (*see* Tickfaw River) I, 338; II, 13
 Blossom rock, San Francisco Harbor, Cal., removal of I, 582; III, 21
 Boards (*see also* Commissions):
 Of Engineers for Rivers and Harbors (*see also* Committee, etc.) I, 36, 6
 Of Ordnance and Fortification I, 8, 9, 12
 On Fortifications or other Defenses (Endicott Board) I, 8
 The Board of Engineers I, 8, 6
 Boat railway, Columbia River, Oreg. and Wash. I, 604; III, 22
 Boats:
 See also Dredge and Snag boats, and Wrecks.
 Rules governing running of steamers on certain streams I, 6
 Bœuf River, La. and Ark., improvement of I, 368, 370; II, 13
 Bogue Chitto, La.:
 Bridge at Franklinton I, 6
 Improvement of I, 336; II, 13

- Bogue Falia, La., improvement of i, 337; ii, 1301
 Bogue Sound, N. C., improvement of waterway via i, 236; ii, 1103
 Boom Island, Mississippi River, Minneapolis, Minn., bridge at i, 650
 Boothbay Harbor, Me., removal of wreck at Ram Island light-house i, 53, 727
 Borden, Thomas (schooner), removal of wreck of i, 103, 819
 Boston Harbor, Mass.:
 Bridges across Fort Point channel at Congress street and Mount Wash-
 ington avenue i, 652
 Defenses of, including report on damp-proofing i, 9; iv, 2374
 Improvement of i, 77, 764
 Wreck, removal of i, 88, 785
 Boulevards. *See* Roads.
 Braddock Point light station, Lake Ontario, N. Y., removal of wreck. i, 575; iii, 2169
 Brandywine Creek or River, Del.:
 Bridge at Wilmington i, 649, 650
 Improvement of Wilmington Harbor i, 174, 992
 Branford Harbor, Conn., improvement of i, 109, 839
 Braxton County, W. Va., bridge of i, 649
 Brays Bayou, Tex., bridge across i, 647, 648
 Brazos River, Tex.:
 Improvement between Richmond and Old Washington i, 357; ii, 1343
 Improvement between Velasco and Richmond i, 354, 357; ii, 1339
 Improvement of mouth i, 358; ii, 1344
 Brazos River Channel and Dock Company (*see* Brazos River) i, 358; ii, 1344
 Brazos Santiago Harbor, Tex., improvement of i, 360; ii, 1346
 Breton Bay, Md., improvement of, including report on project by the Board
 of Engineers for Rivers and Harbors i, 201; ii, 1044, 1045
 Bridge Creek Landing, Va., wharf at i, 660; iv, 2517
 Bridgeport Harbor, Conn., improvement of i, 115, 846
 Bridges:
 Alteration of, obstructing navigation i, 650, 651
 Aqueduct Bridge, Washington, D. C., repair of i, 652; iv, 2483
 Construction of, across navigable waters i, 642
 Highway bridge, Washington, D. C., to replace Long Bridge. i, 643, 653; iv, 2484
 In military divisions and departments i, 667; iv, 2478, 2899
 Memorial Bridge, Washington, D. C. i, 653; iv, 2484
 Ohio River, impeding navigation i, 37
 Rules governing opening of draws i, 642
 Sakonnet River, R. I., alteration of Stone Bridge i, 94, 798
 Yellowstone National Park, construction, etc., of, with report concern-
 ing technical features i, 666; iv, 2444, 2885
 Briggs, Maud (schooner), removal of wreck of i, 88, 785
 Brilliant Station, Pittsburg, Pa., bridge across Allegheny River i, 649
 Bristol, Me., bridge of town of i, 652
 Broad Creek River, Del., improvement of i, 192, 1022
 Broad Sound, Boston Harbor, Mass., improvement of i, 77, 764
 Bronx River, N. Y.:
 Improvement of i, 126, 862
 Removal of wrecks i, 138, 139, 887
 Brooklyn, N. Y. *See* New York Harbor.
 Browns Creek, N. Y., improvement of i, 133, 874
 Brunswick Harbor, Ga., improvement of i, 267; ii, 1164
 Brunswick River, N. C. (*see* Cape Fear River) i, 240; ii, 1109
 Bucksport Harbor, Me., improvement of i, 45, 719
 Budd Inlet, Wash. (*see* Olympia Harbor) i, 626; iii, 2330
 Buffalo Bayou, Tex.:
 Improvement of i, 351; ii, 1334
 Removal of wrecks i, 360, 361; ii, 1347
 Buffalo Fork, Snake River, Wyo., road to Fort Washakie i, 675; iv, 2937
 Buffalo Fork, White River, Ark., improvement of i, 382
 Buffalo Harbor, N. Y.:
 Improvement of i, 559; iii, 2126
 Improvement of Buffalo entrance to Erie Basin and Black Rock Har-
 bor i, 562; iii, 2143
 Improvement of channels in waters connecting Great Lakes i, 532; iii, 2001
 Improvement of Lake Erie entrance to Erie Basin and Black Rock
 Harbor i, 562; iii, 2142

Buildings:

- Army War College.....
- Engineer School of Application.....
- Government Printing Office, Washington, D. C....
- Public, District of Columbia.....
- School of Submarine Defense, Fort Totten, N. Y. ..
- Bulkhead lines. *See* Harbor lines.
- Burlington County, N. J., bridge of.....
- Burlington County Traction Company, bridge across Ra
- Burlington Harbor, Vt., improvement of.....
- Burnite, Jas. K. (schooner), removal of wreck of.....
- Burnt Mills, Tenn., bridge across Obion River.....
- Buttermilk channel, New York Harbor, N. Y.:
 - Improvement of.....
 - Removal of obstruction in.....
- Byram River, N. Y. (*see* Port Chester Harbor).....

C.

- Cable galleries, tanks, etc.....
- Cache River, Ark., improvement of.....
- Cache River, Ill., prevention of Mississippi River from l
- Caddo (Fairy) Lake, Tex. and La. (*see* Cypress Bayou)
- Cairo, Ill., prevention of break in Mississippi River nea
- Calaveras River, Cal. (*see* Stockton and Mormon channe
- Calcasieu Parish, La., bridge of.....
- Calcasieu River, La.:
 - Bridge across.....
 - Improvement of mouth and passes.....
- California Débris Commission.....
- California, department of, reconnaissances and explorat
- Caloosahatchee River, Fla.:
 - Bridge at Beautiful Island.....
 - Bridge at Ferry Crossing, Alva.....
 - Improvement of.....
- Calumet Harbor, Wis. (*see* Fox River).....
- Calumet Harbor and River, Ill. and Ind.:
 - Bridge at Cummings, Ill.....
 - Improvement of harbor.....
 - Improvement of river.....
- Cambridge Harbor, Md., improvement of.....
- Camden, Me., improvement of harbor at.....
- Camden, N. J.:
 - Defenses of Delaware River.....
 - Improvement of Cooper Creek.....
 - Improvement of Delaware River at.....
 - Removal of wreck in Cooper Creek.....
- Canadian canal, St. Marys River, Ontario, commerce th
- Canals, etc. (*see also* Waterways).
 - Albemarle and Chesapeake Canal, N. C., waterway
 - Allegheny River, Pa., locks and dams.....
 - Ashpoo River to South Edisto River, S. C., with e
 - Charleston-Beaufort waterway).....
 - Barren River, Ky., lock and dam.....
 - Bee Tree Shoals Canal, Ala.....
 - Benton Harbor Canal, Mich. (*see* St. Joseph Harbo
 - Big Barren River, Ky., lock and dam.....
 - Big Sandy River, W. Va. and Ky., locks and dams
 - Big Stone Lake, Minn., reservoir dam.....
 - Black River, La., locks and dams.....
 - Black Warrior River, Ala., locks and dams.....
 - Calaveras River, Cal., to Mormon channel, San Joa
 - Canadian canal, St. Marys River, Ontario, commerc
 - Cape Fear River above Wilmington, N. C., locks an
 - Cascades Canal, Columbia River, Oreg.....
 - Chicago Drainage Canal, Ill.....
 - Clubfoot and Harlowe Canal, N. C., waterway via ..

Canals, etc.—Continued.

- Colbert Shoals Canal, Ala. i, 418; ii, 1594
 Columbia River, Cascades Canal. i, 606, 608; iii, 2222, 2224
 Columbia River, The Dalles Rapids to Celilo Falls, locks and dams i, 604; iii, 2221
 Congaree River, S. C., lock and dam. i, 251; ii, 1130
 Coosa River, Ga. and Ala., locks and dams. i, 303, 306; ii, 1230, 1235
 Courtableau Bayou, La., lock and dam. i, 334; ii, 1295
 Cumberland River, Tenn. and Ky., locks and dams. i, 412, 414; ii, 1531, 1585
 Davis Island dam, Ohio River, Pa. i, 435; ii, 1671
 Des Moines Rapids Canal, Mississippi River, with report on enlargement of locks and for dam at foot of rapids i, 395; ii, 1491, 1500
 Dismal Swamp Canal, Va. and N. C., waterway via. i, 225; ii, 1083
 Duluth Canal, Minn., improvement of. i, 466; ii, 1794
 Edisto (South) River to Ashepoo River, S. C., with estimates of cost (see Charleston-Beaufort waterway) i, 255; ii, 1132
 Estherville-Minim Creek Canal, S. C. (see Santee River) i, 248; ii, 1127
 Expenditures for operating and care. i, 36
 Fox River, Wis., locks and dams. i, 489, 491; ii, 1866, 1870
 Galena River, Ill., lock and dam. i, 395; ii, 1498
 Galveston and Brazos Canal, Tex., purchase of. i, 355; ii, 1339
 Gowanus Canal, New York Harbor, N. Y. (see Gowanus Bay) i, 142, 915
 Grand Rapids, Wabash River, lock and dam. i, 457, 459; ii, 1772, 1773
 Great Kanawha River, W. Va., locks and dams. i, 444, 445; ii, 1721, 1723
 Green River, Ky., locks and dams. i, 461; ii, 1775, 1776
 Herr Island, Allegheny River, Pa., lock and dam. i, 438, 439; ii, 1680, 1683
 Illinois and Mississippi Canal, Ill., construction of. i, 496; iii, 1920
 Illinois and Mississippi Canal, Ill., operating and care. i, 395; ii, 1496
 Illinois River, Ill., locks and dams. i, 495, 496; iii, 1915, 1917
 Illinois River, Ill., survey for waterway via. i, 494, 639; iii, 1904; S., 7, 68, 167
 Kameville lock and dam, Illinois River, Ill. i, 496; iii, 1917
 Kanawha River, W. Va., locks and dams. i, 444, 445; ii, 1721, 1723
 Kentucky River, Ky., locks and dams. i, 450, 451; ii, 1748, 1753
 Keweenaw Bay to Lake Superior, improvement and care. i, 471, 472; ii, 1815
 Keweenaw Bay to Lake Superior, wreck. i, 475; ii, 1827
 Lafourche Bayou, La., lock and dam. i, 641
 Lagrange lock and dam, Illinois River, Ill. i, 496; iii, 1917
 Lake Washington Canal, Wash. See Puget Sound.
 Levisa Fork, Big Sandy River, Ky., locks and dams. i, 448; ii, 1742
 Little Kanawha River, W. Va., lock and dam. i, 443, 444; ii, 1718, 1719
 Lockport, Ill., to St. Louis, Mo., survey for waterway i, 494, 639; iii, 1904; S., 7, 68, 167
 Louisville and Portland Canal, improvement and care. i, 452, 455; ii, 1763, 1765
 Marentau River, La., lock and dam. i, 641
 Michigan Lake to Sturgeon Bay, improvement and care. i, 478, 480; ii, 1841, 1846
 Michigan Lake Superior Power Co.'s canal. i, 641
 Minim Creek-Estherville Canal, S. C. (see Santee River) i, 248; ii, 1127
 Mississippi River, Des Moines Rapids Canal, with report on enlargement of locks and for dam at foot of rapids i, 395; ii, 1491, 1500
 Mississippi River to Illinois River, construction of. i, 496; iii, 1920
 Mississippi River to Illinois River, operating and care. i, 395; ii, 1496
 Mississippi River, reservoirs, construction of. i, 398; ii, 1528
 Mississippi River, reservoirs, operating and care. i, 399; ii, 1538
 Mississippi River, St. Paul to Minneapolis, locks and dams. i, 396; ii, 1523
 Monongahela River, locks and dams. i, 427, 429, 431; ii, 1652, 1658, 1660
 Morgan Canal, Tex., improvement of (see Galveston ship channel) i, 351; ii, 1334
 Morgan Canal, Tex., operating and care. i, 353; ii, 1337
 Mormon channel, San Joaquin River, Cal., to Calaveras River. i, 585; iii, 2193
 Mosquito Creek Canal, S. C. (see Santee River) i, 248; ii, 1127
 Muscle Shoals Canal, Ala. i, 417, 419; ii, 1594, 1605
 Muskingum River, Ohio, locks and dams. i, 446, 447; ii, 1731, 1732
 Navigation of, rules governing. i, 641
 North Carolina Cut, N. C., improvement of waterway via. i, 226; ii, 1084
 Ohio River, Lock and Dam 1, at Davis Island, Pa. i, 435; ii, 1671
 Ohio River, Locks and Dams 2-7. i, 435; ii, 1672
 Ohio River, Locks and Dams 8, 11, 13, 18, 19. i, 441; ii, 1713
 Ohio River, Lock and Dam 37. i, 426; ii, 1645

Canals, etc.—Continued.

- Ohio River, Louisville and Portland Canal, improvement and care i, 452, 455; ii, 1763, 1765
- Osage River, Mo., lock and dam i, 408; ii, 1568
- Otter Tail Lake and River, Minn., reservoir dam i, 404; ii, 1548
- Ouachita River, Ark. and La., locks and dams i, 366; ii, 1373
- Plaquemine Bayou, La., lock i, 332; ii, 1289
- Portage Lake canals, Mich., improvement and care i, 471, 472; ii, 1815
- Portage Lake canals, Mich., wreck i, 475; ii, 1827
- Port Arthur Canal, Tex., connection with Sabine Lake i, 344; ii, 1314
- Puget Sound to Lake Washington, bridge at Seattle, Wash. i, 645
- Puget Sound to Lake Washington, improvement i, 629; iii, 2332
- Puget Sound to Lake Washington, reexamination i, 630; iii, 2340
- Red Lake and Red Lake River, Minn., reservoir dam i, 403; ii, 1548
- Regulations governing navigation of i, 641
- Rock River, Ill., construction of canal around i, 496; iii, 1920
- Rock River, Ill., operating and care of canal around i, 395; ii, 1496
- Rough River, Ky., lock and dam i, 463, 464; ii, 1788, 1789
- Rules governing navigation of i, 641
- St. Clair Flats Canal, Mich., improvement and care i, 539, 540; iii, 2033, 2034
- St. Louis, Mo., to Lockport, Ill., survey for waterway i, 494, 639 iii, 1904; S., 7, 68, 167
- St. Marys Falls Canal, Mich., improvement and care... i, 534, 535; iii, 2006, 2010
- St. Marys Falls canals, Mich. and Ontario, commerce i, 535; iii, 2010, 2015
- St. Marys River, Mich., water-power canal at Sault Ste. Marie i, 641
- Salmon Bay, Wash., improvement of waterway via i, 629; iii, 2332
- Salmon Bay, Wash., reexamination of waterway via i, 630; iii, 2340
- Sanitary District of Chicago, Ill., canal of i, 640
- Seattle Canal, Wash., bridge at Seattle i, 645
- Seattle Canal, Wash., improvement of i, 629; iii, 2332
- Seattle Canal, Wash., reexamination of i, 630; iii, 2340
- Shilshole Bay, Wash., improvement of waterway via i, 629; iii, 2332
- Shilshole Bay, Wash., reexamination of waterway via i, 630; iii, 2340
- Six-mile Island, Allegheny River, Pa., lock and dam i, 438; ii, 1680
- South Edisto River to Ashpoo River, S. C., with estimates of cost (*see* Charleston-Beaufort waterway) i, 255; ii, 1132
- Springdale, Pa., lock and dam in Allegheny River i, 438; ii, 1680
- Sturgeon Bay and Lake Michigan Canal, improvement and care i, 478, 480; ii, 1841, 1846
- Superior Lake to Keweenaw Bay, improvement and care.... i, 471, 472; ii, 1815
- Superior Lake to Keweenaw Bay, wreck i, 475; ii, 1827
- Tennessee River, canals, locks, and dams i, 417, 419; ii, 1591, 1594, 1605
- Tombigbee River, Ala., locks and dams i, 310, 312; ii, 1246, 1248
- Traverse Lake, Minn., reservoir dam i, 404; ii, 1549
- Trinity River, Tex., locks and dams i, 354; ii, 1338
- Tug Fork, Big Sandy River, W. Va. and Ky., locks and dams... i, 448; ii, 1742
- Turners Cut, N. C., waterway via i, 225; ii, 1083
- Union Lake, Wash., improvement of waterway via i, 629; iii, 2332
- Union Lake, Wash., reexamination of waterway via i, 630; iii, 2340
- Wabash River, Grand Rapids lock and dam i, 457, 459; ii, 1772, 1773
- Warrior River, Ala., locks and dams i, 309, 315; ii, 1244, 1253, 1256
- Washington Lake to Puget Sound, bridge at Seattle, Wash. i, 645
- Washington Lake to Puget Sound, improvement of waterway... i, 629; iii, 2332
- Washington Lake to Puget Sound, reexamination of waterway... i, 630; iii, 2340
- Washita (Ouachita) River, Ark. and La., locks and dams i, 366; ii, 1373
- White River, Ark., locks and dams i, 381; ii, 1420
- Yamhill River, Oreg., lock and dam i, 609, 612; iii, 2257, 2261
- Canarsie Bay, N. Y., improvement of i, 130, 869
- Cape Ann, Mass.:
- Construction of harbor of refuge in Sandy Bay, with report relative to completion of project i, 62, 740, 742
- Improvement of Rockport Harbor i, 64, 743
- Cape Charles City Harbor, Va., improvement of i, 224; ii, 1081
- Cape Fear River, N. C.:
- Defenses of, including report on damp-proofing and on use of paint made of coal tar and kerosene oil i, 9; iv, 2406
- Improvement above Wilmington i, 239; ii, 1105

Cape Fear River, N. C.—Continued.

- Improvement at and below Wilmington i, 240; ii, 1109
 Improvement of Northeast Branch i, 238; ii, 1105
 Cape Henry, Va., defenses at i, 9
 Cape Poge light-house, Mass., removal of wreck i, 103, 819
 Cape Vincent Harbor, N. Y., improvement of i, 572; iii, 2162
 Capitol, Washington, D. C., telegraph line i, 659; iv, 2517
 Carleton, P. J. (barge), removal of wreck of i, 145, 924
 Carlows Island, Me., bridge to Point Pleasant i, 652
 Carquines Straits, Cal., channel to the Golden Gate (*see* San Pablo Bay) i, 583; iii, 2189
 Carrabelle bar and harbor, Fla., improvement of i, 290; ii, 1207
 Carrabelle, Tallahassee and Georgia Railroad Company, bridges of i, 652
 Carriages, gun and mortar i, 10
 Carters Creek, Va.:
 Improvement of i, 208; ii, 1056
 Removal of wreck i, 218; ii, 1071
 Caruthersville Harbor, Mo. (*see* Mississippi River Commission) i, 639; S., 3, 40
 Carvers Harbor, Me., improvement of i, 48, 722
 Cascades Canal, Columbia River, Oreg.:
 Construction of i, 606; iii, 2222
 Operating and care i, 608; iii, 2224
 Casemates, mining i, 13, 15, 17
 Castlerock, Wash., bridge across Cowlitz River i, 648
 Catahoula Parish, La., bridge of i, 646
 Cedar Bayou, Tex., improvement of i, 354, 356; ii, 1339
 Centennial Lake, Miss. (*see* Vicksburg Harbor) i, 370; ii, 1385
 Central of Georgia Railway Company, bridge of i, 662
 Central Vermont Railway Company, bridge of i, 652
 Champlain Lake, N. Y. and Vt.:
 Burlington Harbor, Vt., improvement of i, 69, 748
 Defenses of i, 9
 Narrows, improvement of i, 72, 752
 North and South Hero islands, improvement of channel between i, 69
 Plattsburg Harbor, N. Y., improvement of i, 72, 751
 Wrecks between Whitehall, N. Y., and Larabee Landing, Vt., removal of i, 73, 753
 Channels. *See* Rivers and harbors.
 Charles River, Mass. (*see* Boston Harbor) i, 78, 766
 Charleston Harbor, S. C.:
 Defenses of, including report on damp-proofing i, 9; iv, 2409
 Improvement of, including dredge construction i, 253, 972; ii, 1134
 Improvement of waterway to Beaufort, S. C. i, 255; ii, 1138
 Improvement of waterway to McClellanville, with estimates of cost. i, 252; ii, 1132
 Removal of logs from waterway to Beaufort, S. C. i, 257; ii, 1140
 Charlevoix Harbor, Mich., improvement of i, 519; iii, 1978
 Charlotte Harbor, Fla., improvement of i, 282; ii, 1194
 Charlotte Harbor, N. Y.:
 Improvement of i, 567; iii, 2153
 Water levels i, 665; iv, 2678
 Charts:
 Land within flats of Anacostia River, D. C. i, 36
 Military and other i, 667, 673; iv, 2478, 2699
 Northern and Northwestern Lakes i, 660, 665; iv, 2671
 Chatham Harbor, Mass.:
 Improvement of i, 88, 785
 Removal of wreck off Hardings Beach light i, 103, 820
 Chattahoochee River, Ga. and Ala., improvement of i, 296; ii, 1218
 Cheboygan Harbor, Mich., improvement of i, 522; iii, 1983
 Cheesapeake Creek, N. J., bridge across i, 650
 Chefuncte River, La., improvement of i, 337; ii, 1301
 Chehalis River, Wash., improvement of i, 623; iii, 2327
 Chelsea Creek, Mass. (*see* Boston Harbor) i, 80, 767
 Chemicals, use of, in destroying the water hyacinth
 i, 279, 343; ii, 1184, 1312; iv, 2433
 Chequamegon Bay, Wis. (*see* Ashland Harbor) i, 469; ii, 1811
 Chesapeake and Ohio Railway Company, bridge of, across Levisa Fork, Big
 Sandy River, Ky. i, 647

Chesapeake Bay, Md. and Va.:	
Defenses at entrance at Cape Henry, Va.	i, 15
Improvement of Cape Charles City Harbor, Va.	i, 224; n, 187
Chester River, Md., improvement of	i, 187, 188
Chicago, Burlington and Quincy Railroad Company, bridge of	i, 600
Chicago Drainage Canal, Ill., connection of Chicago River with	i, 600
Chicago Harbor and River, Ill.:	
Bridge across Little Calumet River	i, 607
Bridge across North Branch at Western avenue	i, 607
Bridge across South Branch at Randolph street	i, 607
Bridges across South Branch at Eighteenth street and at Loomis street	i, 607
Bridge across South Fork of South Branch at Archer avenue	i, 607
Bridge at State street	i, 607
Drainage canal, connection with river	i, 607
Improvement of Calumet (South Chicago) Harbor	i, 493; iii, 188
Improvement of channels in waters connecting Great Lakes	i, 532; iii, 201
Improvement of outer harbor	i, 491; iii, 188
Improvement of river	i, 492; iii, 188
Chicago, Milwaukee and St. Paul Railway Company, bridge of	i, 608
Chickasaw River, Miss.:	
Bridge at Leakesville	i, 645
Improvement of	i, 318; ii, 120
Chief of Engineers, officers on duty in Office of the	i, 608
Chillicothe, Ill., bridge across Illinois River	i, 607
China Basin, San Francisco Harbor, Cal., harbor lines north of	i, 640; iii, 232
Chincoteague Bay, Va., improvement of waterway to Delaware Bay	i, 180, 102
Chincoteague light-house, Va., removal of wreck	i, 194, 102
Chinook River, Wash., bridge across	i, 607
Chipola River, Fla.:	
Improvement of lower river	i, 292; ii, 122
Improvement of upper river	i, 294; ii, 122
Chitto, Bogue, La.:	
Bridge at Franklinton	i, 65
Improvement of	i, 336; ii, 130
Choctawhatchee River, Fla. and Ala., improvement of	i, 298; ii, 122
Choptank River, Md.:	
Improvement of	i, 187, 102
Improvement of Cambridge Harbor	i, 188, 100
Christiana River, Del., improvement of Wilmington Harbor	i, 174, 92
Cincinnati, Ohio:	
Construction of Lock and Dam 37, Ohio River, below	i, 428; ii, 165
General improvement of Ohio River	i, 423; ii, 167
City of Austin (vessel), removal of wreck of	i, 271; ii, 117
Civilian assistants to engineer officers	i, 23
Claiborne Harbor, Md., improvement of	i, 185, 100
Clark Fork, Columbia River, Wash. (see Pend Oreille River)	i, 635; iii, 238
Clatskanie River, Oreg., improvement of	i, 616; iii, 238
Clatsop County, Oreg., bridge of	i, 649
Cleveland Harbor, Ohio:	
Bridges of Newburgh and South Shore Railway Company	i, 650
Bridges, municipal, at Jefferson street	i, 647
Improvement of, including dredge construction	i, 549, 979; iii, 207
Removal of wrecks	i, 556; iii, 216
Water levels	i, 665; iv, 267
Clinch River, Tenn.:	
Bridge at Dossett	i, 644
Improvement of	i, 421; ii, 161
Clinton River, Mich., improvement of	i, 531; iii, 198
Clubfoot and Harlowe Canal, N. C., waterway via	i, 235; ii, 110
Clubfoot Creek, N. C., waterway via	i, 235; ii, 110
Coanjock Bay, N. C., waterway via	i, 226; ii, 106
Coast defenses. See Fortifications.	
Cochecho River, N. H., improvement of	i, 56, 79
Coeymans (North), N. Y., removal of wreck in Hudson River	i, 139, 888
Cogswell, Jas. (barge), removal of wreck of	i, 139, 888
Cohansey Creek, N. J., removal of wreck	i, 194, 102
Cohasset Harbor, Mass., improvement of, including report on project by the Board of Engineers for Rivers and Harbors	i, 83, 773, 774

Collar, B. L. (barge), removal of wreck of	i, 138, 887
College, War, Army, Washington, D. C., buildings for	i, 674; iv, 2931
Colleton County, S. C., bridge of	i, 645
Colorado, department of the, reconnaissances and explorations ..	i, 668, 672; iv, 2916
Columbia, department of the, reconnaissances and explorations ..	i, 668, 672; iv, 2915
Columbia River, Oreg. and Wash.:	
Cascades Canal, construction of	i, 606; iii, 2222
Cascades Canal, operating and care	i, 608; iii, 2224
Celilo, Oreg., improvement above	i, 602; iii, 2218
Celilo Falls to The Dalles Rapids, boat railway	i, 604; iii, 2221
Celilo Falls to The Dalles Rapids, locks and dams	i, 604; iii, 2221
Clark Fork (<i>see</i> Pend Oreille River)	i, 635; iii, 2338
Gauging	i, 619; iii, 2321
Mouth of, defenses at, including report on construction methods and on speaking tubes	i, 9; iv, 2423
Mouth of, improvement at, including dredge construction and report on project	i, 614, 975; iii, 2271, 2275
Mouth of, to Willamette River, improvement from	i, 612; iii, 2263
Three-mile Rapids, improvement at	i, 604; iii, 2221
Tongue Point, Oreg., improvement below	i, 614; iii, 2270
Vancouver, Wash., to Willamette River, improvement from	i, 608; iii, 2228
Commencement Bay, Wash., improvement of Tacoma Harbor	i, 627; iii, 2331
Commercial statistics, Sault Ste. Marie canals, Mich.	i, 535; iii, 2010, 2015
Commissions (<i>see also</i> Boards):	
California Débris Commission	i, 638; iii, 2367
Mississippi River Commission	i, 639; S. 3, 40
Permanent International Commission of Congresses of Navigation	i, 639
Committee on Rivers and Harbors, House of Representatives, reports submitted by Board of Engineers for Rivers and Harbors, in pursuance of resolution of	i, 637
Breton Bay, Md	i, 202; ii, 1045
Cohasset Harbor, Mass	i, 83, 774
Oconto Harbor, Wis	i, 476; ii, 1836
Patuxent River, Md	i, 203; ii, 1048
Scituate Harbor, Mass	i, 84, 777
Compton Creek, N. J., improvement of	i, 154, 948
Comstock, John (schooner), removal of wreck of	i, 145, 924
Conecuh River, Ala., improvement of	i, 301; ii, 1226
Congaree River, S. C.:	
Construction of lock and dam near Granby	i, 251; ii, 1130
Improvement by open-channel work	i, 250; ii, 1129
Congresses of Navigation, Permanent International Commission of	i, 639
Conneaut Harbor, Ohio, improvement of, including dredge construction	i, 555, 979; iii, 2099
Connecticut River, Mass. and Conn.:	
Bridge at Hartford, Conn.	i, 644
Bridge between Springfield and Agawam, Mass. (South End Bridge) ..	i, 652
Improvement below Hartford, Conn.	i, 107, 836
Connecticut River Bridge and Highway District, bridge of	i, 644
Contentnia Creek, N. C., improvement of	i, 232; ii, 1096
Contingencies of rivers and harbors, estimate of appropriation for	i, 636
Continuing contracts	i, 36
Albemarle Sound, N. C., waterway via	i, 225; ii, 1083
Allegheny River, Pa., locks and dams	i, 438; ii, 1680
Ambrose channel, New York Harbor, N. Y.	i, 139, 909, 979
Appomattox River, Va.	i, 223; ii, 1080
Arthur Kill, N. Y. and N. J.	i, 147, 932
Ashtabula Harbor, Ohio	i, 553, 979; iii, 2093
Back Cove, Portland, Me	i, 51, 725
Baltimore Harbor, Md., channel to Curtis Bay	i, 196; ii, 1031
Baltimore Harbor, Md., Patapsco River and channel to	i, 194; ii, 1027
Baltimore Harbor, Md., at Spring Garden	i, 197; ii, 1031
Bay Ridge channel, New York Harbor, N. Y.	i, 142, 915
Bee Tree shoals, Tennessee River, Ala.	i, 418; ii, 1591, 1594
Big Sandy River, W. Va. and Ky., including the forks	i, 448; ii, 1742
Biscayne Bay, Fla	i, 277; ii, 1182
Black River, La	i, 366; ii, 1373

Continuing contracts—Continued.

Black River (Lorain) Harbor, Ohio.....	i, 547; iii, 206
Black Rock Harbor, Buffalo, N. Y., Lake Erie entrance.....	i, 562; iii, 214
Black Warrior River, Ala., above Tuscaloosa.....	i, 309; ii, 124
Black Warrior River, Ala., below Tuscaloosa.....	i, 309; ii, 124
Boston Harbor, Mass.....	i, 77, 76
Bridgeport Harbor, Conn.....	i, 115, 84
Buffalo Bayou, Tex.....	i, 351; ii, 133
Buffalo Harbor, N. Y.....	i, 559; iii, 212
Buffalo Harbor, N. Y., lake Erie entrance to Erie Basin and Black Rock Harbor.....	i, 562; iii, 214
Calumet Harbor, Ill.....	i, 493; iii, 189
Charleston Harbor, S. C.....	i, 253, 972; ii, 113
Christiana River, Del.....	i, 174, 996
Cleveland Harbor, Ohio.....	i, 549, 979; iii, 207
Colbert shoals, Tennessee River, Ala.....	i, 418; ii, 1591, 1594
Columbia River, Oreg. and Wash., at the mouth.....	i, 614, 975; iii, 2271, 2275
Columbia River, Oreg. and Wash., The Dalles Rapids to Celilo Falls.....	i, 604; iii, 2221
Congaree River, S. C., between Columbia and Granby.....	i, 251; ii, 1130
Conneaut Harbor, Ohio.....	i, 555, 979; iii, 2096
Croatan Sound, N. C., waterway via.....	i, 225; ii, 1083
Cumberland Sound, Ga. and Fla.....	i, 270, 974; ii, 1168
Curtis Bay, Baltimore, Md., channel to.....	i, 196; ii, 1031
Deep Creek, Va.....	i, 225; ii, 1083
Delaware Bay, Del., harbor of refuge.....	i, 164, 970
Delaware River, N. J., Pa., and Del.....	i, 159, 957
Detroit River, Mich.....	i, 540; iii, 2036
Dog River, Miss.....	i, 315 ii, 1258
Duluth Harbor, Minn.....	i, 466 ii, 1794
East (Ambrose) channel, New York Harbor, N. Y.....	i, 139, 909, 979
Elizabeth River, Va., Hospital Point, Norfolk.....	i, 220; ii, 1071
Elizabeth River, Va., waterway to sounds of North Carolina.....	i, 225; ii, 1083
Erie Basin, Buffalo, N. Y., Lake Erie entrance.....	i, 562; iii, 214
Everett Harbor, Wash.....	i, 631; iii, 2334
Fall River Harbor, Mass.....	i, 97, 603
Falls of Ohio River at Louisville, Ky.....	i, 452; ii, 1763
Galveston Harbor, Tex.....	i, 348; ii, 1321
Galveston Harbor, Tex., inner bar to Fifty-first street.....	i, 350; ii, 1328
Galveston-Houston waterway, Tex.....	i, 351; ii, 1334
Gloucester Harbor, Mass.....	i, 65, 74
Gowanus Bay channels, New York Harbor, N. Y.....	i, 142, 915
Grays Harbor and bar entrance, Wash.....	i, 621; iii, 2325
Great Lakes, channels in connecting waters of.....	i, 532; iii, 2001
Great Pedee River, S. C.....	i, 245; ii, 1120
Gulfport, Miss., channel to Ship Island Harbor.....	i, 320; ii, 1266
Hampton Roads, Va.....	i, 221; ii, 1076
Harbor Beach, Mich.....	i, 526; iii, 1989
Hay Lake channel, St. Marys River, Mich.....	i, 537; iii, 2027
Horn Island Harbor, Miss.....	i, 315; ii, 1258
Hospital Point, Norfolk Harbor, Va.....	i, 220; ii, 1074
Houston-Galveston waterway, Tex.....	i, 351; ii, 1334
Hudson River, N. Y.....	i, 135, 877
Illinois and Mississippi Canal, Ill.....	i, 496; iii, 1920
Indiana Chute, Falls of Ohio River, Louisville, Ky.....	i, 452; ii, 1763
Kalamazoo River, Mich.....	i, 504; iii, 1945
Kennebec River, Me.....	i, 50, 724
Kentucky River, Ky.....	i, 450; ii, 1748
Keweenaw Bay to Lake Superior, Mich., waterway.....	i, 471; ii, 1815
Levisa Fork, Big Sandy River, Ky.....	i, 448; ii, 1742
Lorain Harbor, Ohio.....	i, 547; iii, 206
Louisville and Portland Canal, Ky.....	i, 452; ii, 1763
Loutre, Pass a, Mississippi River, sill across.....	i, 325; ii, 1276
Ludington Harbor, Mich.....	i, 514; iii, 1966
Marquette Harbor, Mich.....	i, 473; ii, 1820
Maumee Bay and River, Ohio (<i>see</i> Toledo Harbor).....	i, 542, 979; iii, 2049
Michigan City outer harbor, Ind.....	i, 498, 499; iii, 1931

Continuing contracts—Continued.

Michigan Lake-Sturgeon Bay Canal, including harbor of refuge..	i, 478; ii, 1841
Mississippi River, Head of Passes to Ohio River	i, 639; S., 3, 40
Mississippi River, between Missouri and Ohio rivers	i, 390; ii, 1445
Mississippi River, between Missouri River and St. Paul	i, 393; ii, 1468
Mississippi River, sill across Pass a Loutre	i, 325; ii, 1276
Mississippi River, between St. Paul and Minneapolis	i, 396; ii, 1523
Mississippi River, Southwest Pass	i, 326, 980; ii, 1277
Mississippi River, Vicksburg Harbor, Miss	i, 370; ii, 1385
Mobile Harbor, Ala.	i, 307; ii, 1237
Monongahela River, W. Va. and Pa	i, 427, 429; ii, 1652, 1658
Mormon channel, San Joaquin River, Cal	i, 585; iii, 2193
Narragansett Bay, R. I.	i, 96, 801
Neebish channels, St. Marys River, Mich.	i, 537; iii, 2027
New Haven Harbor, Conn	i, 110, 839
New London Harbor, Conn	i, 105, 833
New York Harbor, N. Y., Ambrose channel	i, 139, 909, 979
New York Harbor, N. Y., Gowanus Bay channels	i, 142, 915
Norfolk Harbor, Va., Hospital Point	i, 220; ii, 1074
Norfolk Harbor, Va., waterway to sounds of North Carolina	i, 225; ii, 1083
Northern and Northwestern Lakes, channels connecting	i, 532; iii, 2001
Oakland Harbor, Cal	i, 582; ii, 2186
Ocmulgee River, Ga	i, 266; ii, 1161
Ohio River, Dams Nos. 2-5	i, 435; ii, 1672
Ohio River, Dams Nos. 8, 11, 13, and 18	i, 441; ii, 1713
Ohio River, Dam No. 37	i, 426; ii, 1645
Ohio River, Falls of, at Louisville, Ky	i, 452; ii, 1763
Ouachita River, Ark. and La	i, 366; ii, 1373
Pamlico Sound, N. C., waterway to Norfolk Harbor, Va	i, 225; ii, 1083
Pascagoula River, Miss., below mouth of Dog River	i, 315; ii, 1258
Pasquotank River, N. C., waterway via	i, 225; ii, 1083
Passaic River, N. J	i, 145, 927
Pass a Loutre, Mississippi River, sill across	i, 325; ii, 1276
Patapeco River, Md., and channel to Baltimore	i, 194; ii, 1027
Patapeco River, Md., channel to Curtis Bay	i, 196; ii, 1031
Patapeco River, Md., harbor of southwest Baltimore (Spring Garden)	i, 197; ii, 1031
Pedee River, S. C	i, 245; ii, 1120
Plaquemine Bayou, La	i, 332; ii, 1289
Portage Lake, Mich., harbor of refuge	i, 517; iii, 1973
Portland Harbor, Me., including Back Cove	i, 51, 725
Potomac River below Washington, D. C	i, 200; ii, 1038
Providence River, R. I	i, 95, 801
Red Hook channel, New York Harbor, N. Y	i, 142, 915
Rockland Harbor, Me	i, 47, 721
Sacramento River, Cal	i, 587; iii, 2194
St. Johns River, Fla., Jacksonville to the ocean	i, 271, 976; ii, 1173
St. Joseph Harbor, Mich.	i, 501; iii, 1937
St. Marys River, Mich., at the falls	i, 534; iii, 2006
St. Marys River, Mich., Hay Lake and Neebish channels	i, 537; iii, 2027
Sandbeach harbor of refuge, Mich	i, 526; iii, 1989
San Diego Harbor, Cal	i, 575; iii, 2171
San Francisco Harbor, Cal	i, 582; iii, 2184
San Joaquin River, Cal., Stockton and Mormon channels	i, 585; iii, 2193
San Pablo Bay, Cal	i, 583; iii, 2189
San Pedro Bay, Cal	i, 576; iii, 2173
Saugatuck Harbor, Mich	i, 504; iii, 1945
Savannah Harbor, Ga	i, 257, 980; ii, 1141
Savannah River, Ga., between Augusta and Savannah	i, 260; ii, 1152
Ship channel connecting waters of the Great Lakes	i, 532; iii, 2001
Ship Island Harbor, Miss., channel to Gulfport	i, 320; ii, 1266
South Chicago Harbor, Ill. (see Calumet Harbor)	i, 493; iii, 1896
Southwest Baltimore Harbor, Md., at Spring Garden	i, 197; ii, 1031
Southwest Pass, Mississippi River	i, 326, 980; ii, 1277
Spring Garden, southwest Baltimore Harbor, Md.	i, 197; ii, 1031
Staten Island Sound, N. Y. and N. J	i, 147, 932
Stockton channel, San Joaquin River, Cal	i, 585; iii, 2193

Continuing contracts—Continued.

- Sturgeon Bay Canal, including harbor of refuge I, 478; II, 18
 Superior Harbor, Wis I, 466; II, 17
 Superior Lake to Keweenaw Bay, Mich., waterway I, 471; II, 18
 Tacoma Harbor, Wash I, 627; III, 23
 Tampa Bay, Fla I, 284; II, 11
 Tennessee River, Ala., Colbert and Bee Tree shoals I, 418; II, 1591, 15
 Toledo Harbor, Ohio I, 542, 979; III, 20
 Tombigbee River, Ala., between mouth and Demopolis I, 309; II, 12
 Trinity River, Tex., locks and dams I, 354; II, 13
 Tug Fork, Big Sandy River, W. Va. and Ky I, 448; II, 17
 Turners Cut, N. C., waterway via I, 225; II, 10
 Union River, Me I, 41, 71
 Vicksburg Harbor, Miss I, 370; II, 13
 Warrior River, Ala., above Tuscaloosa I, 309; II, 124
 Warrior River, Ala., below Tuscaloosa I, 309; II, 124
 Washita (Ouachita) River, Ark. and La. I, 366; II, 137
 Waukegan Harbor, Ill. I, 488; II, 186
 White River, Ark., locks and dams on upper portion I, 381; II, 142
 Wilmington, Cal., outer harbor I, 576; III, 217
 Wilmington, Del., harbor at I, 174, 96
 Winyah Bay, S. C. I, 246; II, 112
 Yazoo River, Miss., at the mouth I, 370; II, 138
- Contracts, continuing. *See* Continuing contracts.
- Conway, S. C., bridge across Waccamaw River I, 65
 Conway and Seashore Railroad Company, bridge of I, 65
 Cooper Creek, N. J.:
 Improvement of I, 167, 98
 Removal of wreck I, 194, 102
- Coosa River, Ga. and Ala.:
 Improvement above East Tenn., Va. and Ga. R. R. bridge.. I, 303, 304; II, 123
 Improvement below East Tenn., Va. and Ga. R. R. bridge.. I, 303, 305; II, 123
 Operating and care of locks and dams I, 306; II, 123
- Coosawattee River, Ga., improvement of I, 303, 305; II, 123
- Coos Bay, Harbor, and River, Oreg.:
 Improvement of entrance to bay and harbor I, 595; III, 220
 Improvement of river I, 597; III, 221
- Coquille River, Oreg., improvement of I, 593; III, 220
- Corney Bayou, La., improvement of I, 368, 370; II, 137
- Corps of Engineers:
 Engineer equipment of troops and civilian assistants to engineer officers. I, 23, 69
 Engineer School of Application I, 19, 674, 675, 689; IV, 293
 Laws of 57th Congress, second session, affecting the IV, 294
 Officers on duty in Office of the Chief of Engineers I, 67
 Personnel I, 3, 5, 18, 669, 686; IV, 290
 Service of officers abroad and in the field, with troops I, 2
- Coscob Harbor, Conn., improvement of I, 122, 85
- Cottrell (schooner), removal of wreck of I, 281; II, 118
- Council Bluffs, Iowa, bridge across Missouri River to East Omaha, Nebr. I, 64
- Courtableau Bayou, La., improvement of I, 334; II, 129
- Cowlitz River, Wash.:
 Bridge across I, 64
 Improvement of I, 617; III, 231
- Craft, water:
 See also Dredge and Snag boats, and Wrecks.
 Rules governing running of steamboats on certain streams I, 64
- Craigs Point, Manatee River, Fla., bridge at I, 64
- Croatan Sound, N. C., improvement of waterway via I, 225; II, 108
- Crooked (Carrabelle) River, Fla. (*see* Carrabelle bar and harbor) I, 290; II, 120
- Cross Creek Township, W. Va., bridge across Ohio River to Steubenville, Ohio. I, 64
- Cross ledge light-house, Delaware Bay, removal of wreck I, 165, 97
- Croydon, Pa., bridge across Neshaminy Creek I, 64
- Crystal River, Fla., improvement of I, 286; II, 120
- Cumberland River, Tenn. and Ky.:
 Bridge in Davidson County, Tenn. I, 64
 Gauging (*see* Mississippi River Commission) I, 639; S., 7, 8, 62, 9
 Improvement above Nashville, Tenn I, 414; II, 158

Cumberland River, Tenn. and Ky.—Continued.

Improvement below Nashville, Tenn	i, 412; ii, 1581
Removal of wreck at Dover Island Chute	i, 417; ii, 1589
Cumberland Sound, Ga. and Fla.:	
Improvement of, including dredge construction	i, 270, 974; ii, 1168
Improvement of waterway between Savannah and Fernandina ..	i, 269; ii, 1166
Removal of wrecks	i, 271; ii, 1171
Cummings, Ill., bridge across Calumet River at	i, 643, 644
Current River, Ark., and Mo., improvement of	i, 385; ii, 1434
Currituck Sound, N. C., improvement of waterway via	i, 226; ii, 1084
Curtis Bay, Baltimore, Md., improvement of channel to	i, 196; ii, 1031
Cut-off, Apalachicola River, Fla., improvement of	i, 292; ii, 1212
Cuyahoga River, Ohio. <i>See</i> Cleveland Harbor.	
Cypress Bayou, Tex. and La., improvement of	i, 365; ii, 1372

D.

Dade County, Fla., bridge of	i, 646
Daisy (bugeye), removal of wreck of	i, 218; ii, 1071
Daisy (flatboat), removal of wreck of, in Buffalo Bayou, Tex.	i, 360, 361; ii, 1347
Dalecarlia reservoir, Washington Aqueduct, D. C.	i, 654; iv, 2485
Dams. <i>See</i> Canals and Waterways.	
D'Arbonne Bayou, La., improvement of	i, 368, 370; ii, 1379
Darien Harbor, Ga., improvement of	i, 282; ii, 1156
Davidson, Gen. William Lee, monument to	i, 676; iv, 2939
Davis, Chas. H. (steamer), removal of wreck of	i, 556; iii, 2105
Davis Island dam, Ohio River, Pa.:	
Operating and care	i, 435; ii, 1671
Survey of Pool No. 1 for increased depth and additional harbor facilities	i, 434; ii, 1688
Deal Island Harbor, Md., removal of wrecks	i, 194, 1024
Débris, mining, in California	i, 638; iii, 2367
Deep Creek Branch, Elizabeth River, Va., waterway via	i, 225; ii, 1083
Defenses, seacoast. <i>See</i> Fortifications.	
Delaware Bay and River, N. J., Pa., and Del.:	
Defenses of	i, 9
Delaware Breakwater, Del., maintenance and repair of	i, 163, 969
Harbor lines between Edgemoor and Christiana River	i, 640, 981
Harbor of refuge in bay, construction of	i, 164, 970
Improvement of river	i, 159, 957
Lewes, Del., iron pier near, maintenance and repair of	i, 163, 968
Marcushook, Pa., improvement of ice harbor	i, 166, 984
Waterway to Chincoteague Bay, Va., improvement of	i, 180, 1002
Wrecks, removal of	i, 165, 971, 972
Delta Point, La. (<i>see</i> Mississippi River Commission)	i, 639; S., 3, 40
Department of Justice. <i>See</i> Attorney-General.	
Departments, Executive, Washington, D. C., telegraph line and improvement of grounds	i, 659; iv, 2517
Departments, military, reconnaissances and explorations	i, 667; iv, 2478, 2899
Depots, engineer	i, 19, 21, 23, 694, 703, 705
Derelicts. <i>See</i> Wrecks.	
Deschutes River, Wash.:	
Bridge at Olympia	i, 645
Improvement of Olympia Harbor	i, 626; iii, 2330
Des Glaises Bayou, La., bridges across	i, 648
Des Moines Rapids Canal, Mississippi River:	
Examination for enlargement of locks, with estimates of cost, and for dam at foot of rapids	ii, 1500
Operating and care of, including dry dock	i, 395; ii, 1491
Des Plaines River, Ill., survey for waterway from Lockport, Ill., to St. Louis, Mo.	i, 494, 639; iii, 1904; S., 7, 68, 167
Details, technical, of engineering methods. <i>See</i> Technical details.	
Detroit River, Mich.:	
Improvement of	i, 540; iii, 2036
Improvement of channels in waters connecting Great Lakes	i, 532; iii, 2001
Survey from Detroit to Lake Erie, final report on	i, 542
Surveys, etc. (<i>see</i> Northern and Northwestern Lakes)	i, 660; iv, 2671
Disappearing gun carriages	i, 10

- Discharge measurements. *See* Gauging.
- Dismal Swamp Canal, Va. and N. C., improvement of waterway via. i, 225; ii, 1
- District of Columbia. *See* Washington.
- Dividing Creek (La Trappe River), Md., improvement of i, 191, 1
- Division, engineers i
- Division of the Philippines, reconnaissances and explorations i, 668, 669; iv, 2478, 2
- Divisions, engineer i
- Doboy bar, Ga., improvement of i, 263; ii, 1
- Dock lines. *See* Harbor lines.
- Dog River, Miss. (*see* Pascagoula River) i, 315; ii, 1
- Dora, Amy (steamer), removal of wreck of i, 194, 1
- Dossett, Tenn., bridge across Clinch River i, 1
- Double Bayou, Tex., improvement of i, 354; ii, 1
- Dover Island Chute, Cumberland River, removal of wreck i, 417; ii, 1
- Drawbridges:
See also Bridges.
 Rules for opening of i, 1
- Drawings. *See* Maps.
- Dredge boats recently authorized:
- Arkansas River i, 376; ii, 1
 - Ashtabula Harbor, Ohio i, 553, 1
 - Charleston Harbor, S. C. i, 253, 1
 - Cleveland Harbor, Ohio i, 549, 1
 - Columbia River, Oreg. and Wash., mouth of i, 614, 1
 - Columbia River, Oreg. and Wash., from mouth to Willamette River i, 612; iii, 2
 - Conneaut Harbor, Ohio i, 555, 1
 - Cumberland Sound, Ga. and Fla. i, 270, 1
 - Fairport Harbor, Ohio i, 551, 1
 - Florida, works in i, 280; ii, 1
 - Fox River, Wis. i, 489; ii, 1
 - Grand River, Mich. i, 509; iii, 1
 - Key West Harbor, Fla. i, 278, 1
 - Michigan Lake, harbors on eastern shore i, 498, 1
 - Mississippi River, Head of Passes to Ohio River i, 639; S., 3
 - Mississippi River, passes of i, 325, 326, 973, 980; ii, 1276, 1
 - Monongahela River, Pa. i, 429; ii, 1
 - New York Harbor, N. Y. i, 139, 1
 - Pensacola Harbor, Fla. i, 299, 1
 - St. Johns River, Fla. i, 271, 1
 - Sandusky Harbor, Ohio i, 545, 1
 - San Pedro (Wilmington), Cal., inner harbor i, 577; iii, 2
 - Savannah Harbor, Ga. i, 257, 1
 - Southwest Pass, Mississippi River i, 325, 326, 1
 - Tennessee River below Riverton, Ala. i, 419; ii, 1591, 1
 - Texas coast i, 354; ii, 1
 - Toledo Harbor, Ohio i, 542, 1
 - Willamette River, Oreg., below Portland i, 612; iii, 2
 - Wilmington, Cal., inner harbor i, 577; iii, 2
- Dredge No. 3, removal of wreck of, in Galveston Bay, Tex. i, 360, 361; ii, 1
- Duck Creek (Smyrna River), Del., improvement of i, 179, 1
- Duck Island Harbor, Conn., construction of harbor of refuge i, 108, 1
- Duluth Canal and Harbor, Minn.:
- Harbor lines in Lake Superior i, 640; ii, 1
 - Improvement of i, 466; ii, 1
 - Improvement of channels in waters connecting Great Lakes i, 532; iii, 2
 - Removal of wrecks in Lake Superior ii, 1
- Dunbar, George (steamer), removal of wreck of i, 556; iii, 2
- Dunkirk Harbor, N. Y., improvement of i, 558; iii, 2
- Dunnellon Phosphate Company, improvement of Withlacoochee River by i, 289; ii, 1
- Duwamish River, Wash. (*see* Puget Sound) i, 625; iii, 2
- Duxbury Harbor, Mass., improvement of i, 85, 1
- Dyer County, Tenn., bridge of i, 1

E.

- East (Ambrose) channel, New York Harbor, N. Y., improvement of. i, 139, 909, 979
 East Chester Bay, N. Y., bridge in Pelham Bay Park. i, 650
 East Chester Creek, N. Y., improvement of. i, 127, 864
 East, department of the, reconnaissances and explorations. i, 668; iv, 2902
 Eastern Branch, Elizabeth River, Va. (*see* Norfolk Harbor). i, 219; ii, 1074
 Eastern Branch, Potomac River. *See* Anacostia River.
 East Omaha, Nebr., bridge across Missouri River to Council Bluffs, Iowa. i, 642
 East Pass, Carrabelle Harbor, Fla., improvement of. i, 290; ii, 1207
 East River, Ga. (*see* Brunswick Harbor). i, 267; ii, 1164
 East River, N. Y.:
 Harbor lines at North Brother Island, Lawrence Point, and Berrian
 Island, and between East Thirteenth and East Eighteenth streets,
 New York City. i, 640, 888, 891, 895
 Improvement of. i, 131, 871
 Removal of wreck. i, 139, 887
 Echo Bay Harbor, N. Y., improvement of. i, 126, 861
 Eddy, D. M., bridge of. i, 648
 Edenton Bay, N. C., improvement of. i, 227; ii, 1086
 Edgemoor, Del., harbor lines in Delaware River to Christiana River. i, 640, 981
 Edisto (South) River, S. C., waterway via, with estimates of cost. i, 255; ii, 1132
 Eel River, Mass. (*see* Plymouth Harbor). i, 86, 782
 Eighteen-mile Creek, N. Y. (*see* Olcott Harbor). i, 566; iii, 2151
 Eldorado (barge), removal of wreck of. i, 158, 954
 Eldorado and Bastrop Railway Company, bridge of. i, 643
 Electrical connections at fortifications. i, 14, 15, 16, 17
 Elizabeth, Pa., harbor lines in Monongahela River. i, 640; ii, 1698
 Elizabethport, N. J., removal of wreck in Arthur Kill. i, 158, 159, 955
 Elizabeth River, N. J.:
 Improvement of. i, 154, 947
 Removal of wreck. i, 159, 955
 Elizabeth River, Va.:
 Harbor lines at Atlantic City bridge, at mouth of Smith Creek. i, 640; ii, 1089
 Improvement of Norfolk Harbor and its approaches, including Hos-
 pital Point. i, 219; ii, 1074
 Improvement of waterway to Albemarle Sound, via Currituck
 Sound. i, 228; ii, 1084
 Improvement of waterway to sounds of North Carolina, via Pasquotank
 River. i, 225; ii, 1083
 Improvement of Western Branch. i, 220; ii, 1076
 Elkpoint, S. Dak. (*see* Missouri River). i, 405; ii, 1551
 Elk River, Md., improvement of. i, 182, 1003
 Elk River, W. Va., improvement of. i, 446; ii, 1729
 Embankments. i, 13, 16, 17
 Emlin, C. (steamer), removal of wreck of. i, 306; ii, 1236
 Emory River, Tenn., bridge at Harriman. i, 643
 Emplacements. i, 10, 11
 Employees as civilian assistants to engineer officers. i, 23
 Endicott Board. i, 8, 9
 Engineer depots. i, 19, 21, 23, 694, 703, 705
 Engineer divisions. i, 36
 Engineer equipment of troops. i, 23, 697
 Engineering methods, technical details of. *See* Technical details.
 Engineer officers, civilian assistants to. i, 23
 Engineer School of Application. i, 19, 674, 675, 689; iv, 2934
 Engineer troops. *See* Troops.
 Engineers, Battalions of. i, 5, 18, 686; iv, 2906
 Engineers, Boards of. *See* Boards.
 Engineers, Corps of:
 Engineer equipment of troops and civilian assistants to engineer offi-
 cers. i, 23, 697
 Engineer School of Application. i, 19, 674, 675, 689; iv, 2934
 Laws of 57th Congress, second session, affecting the. iv, 2943
 Officers on duty in Office of the Chief of Engineers. i, 676
 Personnel. i, 3, 5, 18, 669, 686; iv, 2906
 Service of officers abroad and in the field, with troops. i, 24

- Engineers, division I, 36
 Engineers, Office of the Chief of, officers on duty I, 676
 Engineers, The Board of I, 8, 679
 English Bayou, La., bridge across I, 647
 Equipment, engineer, of troops I, 23, 697
 Erie Basin, Buffalo, N. Y.:
 Improvement of Buffalo entrance to I, 562; III, 2143
 Improvement of Lake Erie entrance to I, 562; III, 2142
 Erie Harbor, Pa., improvement of, use of land at Presque Isle Peninsula for
 water-supply purposes, and status of title I, 557; III, 2115
 Erie Lake (*see also* Northern and Northwestern Lakes):
 Dredge boat for harbors on. *See* Dredge boats, etc.
 Removal of wrecks I, 556; III, 2103
 Water levels I, 665; IV, 2678
 Escambia River, Fla., improvement of I, 301; II, 1226
 Esopus Creek, N. Y. (*see* Saugerties Harbor) I, 136, 883
 Estherville-Minim Creek Canal, S. C. (*see* Santee River) I, 248; II, 1127
 Estimates of appropriations required:
 Fortifications I, 17
 Rivers and harbors, etc I, 36, 636
 Eureka, Cal. (*see* Humboldt Harbor) I, 591; III, 2199
 Evansville, Ind. (*see* Ohio River) I, 423; II, 1627
 Evaporation, outflow, and rainfall in valley of Northern and Northwestern
 Lakes I, 665; IV, 2855
 Everett, Mass., bridge across Malden River to Medford I, 650
 Everett Harbor, Wash., improvement of I, 631; III, 2334
 Examinations of rivers and harbors:
 Estimate of appropriation for I, 636
 Required to be made by act of 1902 I, 36
 Executive Departments, Washington, D. C., telegraph line and improve-
 ment of grounds I, 659; IV, 2517
 Executive Mansion and office, Washington, D. C. I, 658; IV, 2517
 Exeter River, N. H., improvement of I, 57, 735
 Explorations and reconnaissances, military, with report on technical fea-
 tures of engineer operations in the former department of North Philip-
 pines, and present Department of Luzon I, 667; IV, 2478, 2903
- F.**
- Fairhaven Harbor, Mass.:
 Harbor lines I, 640, 820
 Improvement of New Bedford Harbor I, 92, 794
 Fairmont, W. Va., bridge across Monongahela River I, 651
 Fairport Harbor, Ohio:
 Improvement of, including dredge construction I, 551, 979; III, 2084
 Removal of wreck I, 556; III, 2106
 Fairy Lake, Tex. and La. (*see* Cypress Bayou) I, 365; II, 1372
 Falia, Bogue, La., improvement of I, 337; II, 1301
 Fall River Harbor, Mass., improvement of I, 97, 803
 Falls of Ohio River, Louisville, Ky.:
 Improvement of I, 452; II, 1763
 Operating and care of Louisville and Portland Canal I, 455; II, 1765
 False Egg Island Point, Delaware Bay, removal of wreck I, 165, 971
 Feather River, Cal.:
 Improvement of I, 587; III, 2194
 Improvement of, by California Débris Commission I, 638; III, 2368
 Fenwicks Island shoal, Md., removal of wreck I, 194, 1024
 Fernandina, Fla.:
 Improvement of Cumberland Sound I, 270; II, 1168
 Improvement of waterway to Savannah, Ga. I, 269; II, 1166
 Ferry Crossing, Caloosahatchee River, Alva, Fla., bridge at I, 647
 Ferry (Fairy) Lake, Tex. and La. (*see* Cypress Bayou) I, 365; II, 1372
 Fidelia (barge), removal of wreck of I, 103, 820
 Field:
 Reconnaissances, explorations, etc., in the I, 667; IV, 2478, 2899
 Services of officers of the Corps of Engineers in the, with troops I, 24
 Filtration plant, Washington Aqueduct, D. C., with report concerning pre-
 liminary treatment of Potomac water I, 657; IV, 2505, 2511
 Finders, range and position I, 12, 15, 17

- Fire Island Inlet, N. Y. (*see* Great South Bay) i, 134, 875
- Fisher, Antoinette (barge), removal of wreck of i, 159, 955
- Fisher, Leon (barge), removal of wreck of i, 159, 955
- Fishing Creek, N. C., improvement of i, 230; ii, 1093
- Five-mile River Harbor, Conn., improvement of i, 119, 850
- Flag River, Wis. (*see* Portwing Harbor) i, 468; ii, 1809
- Flat Lake, La. (*see* Grand River) i, 332; ii, 1289, 1312
- Flint River, Ga., improvement of i, 295; ii, 1215
- Flint River, Mich., improvement of i, 525; iii, 1986
- Florence, Oreg., examination and survey of Siuslaw River at and near i, 599; iii, 2229
- Florida:
- Defenses of coast, including report on damp proofing i, 9; iv, 2413
 - Dredge boat for Key West Harbor i, 278, 980
 - Dredge boat for Pensacola Harbor i, 299, 977
 - Dredge boat for St. Johns River i, 271, 976
 - Dredge and snag boat for works in i, 280; ii, 1186
 - Removal of water hyacinths from waters in, including report on experiments made i, 279; ii, 1184; iv, 2433
- Florida Coast Line Canal and Transportation Company (*see* Indian River) i, 276; ii, 1181
- Florida East Coast Railway Company:
- Construction of basin at Miami, Fla., by i, 277; ii, 1182
 - Construction of bridge by i, 648
- Florida Southern Railroad Company, bridge of i, 649
- Flushing Bay, N. Y., improvement of i, 129, 868
- Footbridge across Potomac River at Washington, D. C., to replace Long Bridge i, 643, 653; iv, 2484
- Footte, Fort, Potomac River, Md. i, 17, 18, 685
- Foreign possessions. *See* Insular possessions.
- Fore River, Mass. *See* Weymouth River.
- Forked Deer River, Tenn., improvement of i, 411; ii, 1579
- Fort Foote, Potomac River, Md. i, 17, 18, 685
- Fort-Gibson, Ind. T., bridge across Arkansas River near i, 642
- Fortifications (*see also* Technical details):
- Appropriations required for 1904-5, estimates of i, 17
 - Board of Engineers, The i, 8, 679
 - Board of Ordnance and Fortification i, 8, 9, 12, 16
 - Board on Fortifications or other Defenses (Endicott Board) i, 8, 9
 - Building for School of Submarine Defense i, 13, 16
 - Carriages, gun and mortar i, 10
 - Financial statement i, 14
 - General statement, suggestions, and progress of work i, 8, 9
 - Gun and mortar batteries i, 9, 14, 17
 - Insular possessions i, 8, 9, 14, 17
 - Preservation and repair of i, 12, 15, 17
 - Projects i, 8, 9, 16, 17
 - Range and position finders i, 12, 15, 17
 - Searchlights and electrical connections, with notes on projects i, 14, 15, 16, 17; iv, 2425
 - Sea walls and embankments i, 13, 16, 17
 - Sites i, 13, 14, 15, 17
 - Submarine mines i, 13, 15, 17
 - Supplies for seacoast defenses i, 12, 16, 17
- Fort Leavenworth, Kans.:
- Engineer depot at i, 21, 23, 703
 - Engineer troops at i, 5
- Fort Lee, N. J., harbor lines in Hudson River i, 640, 905
- Fort Pierre, S. Dak. (*see* Missouri River) i, 405; ii, 1551
- Fort Point channel, Boston, Mass.:
- Bridges at Congress street and Mount Washington avenue i, 652
 - Improvement of i, 79, 767
- Fort Totten, N. Y., building for School of Submarine Defense i, 13, 16
- Fort Washakie, Wyo., road to Buffalo Fork, Snake River i, 675; iv, 2937
- Fort William McKinley, Manila Bay, P. I. iv, 2481, 2907
- Fox River, Wis.:
- Bridge at Appleton i, 646
 - Bridge at Oshkosh i, 645

Fox River, Wis.—Continued.

Harbor lines at Oshkosh and Greenbay	i, 640; ii, 1883, 1
Improvement of	i, 489; ii, 1
Improvement of Greenbay Harbor	i, 477; ii, 1
Operating and care of locks and dams	i, 491; ii, 1
Franconia (vessel), removal of wreck of	i, 271; ii, 1
Frankfort Harbor, Mich., improvement of	i, 518; iii, 1
Franklin, La., bridge across Bayou Teche	i,
Franklin, Pa.:	
Bridge across Allegheny River at (county bridge)	i,
Bridge across Allegheny River near (Big Rock Bridge)	i,
Franklinton, La., bridge across Bogue Chitto	i,
French Broad River, Tenn., improvement of	i, 420; ii, 1
Frenchman Bay, Me., defenses of, including report on telephone booths and damp-proofing	i, 9; iv, 2
Friend, Lottie K. (schooner), removal of wreck of	i, 165,

G.

Galena River, Ill., operating and care of lock and dam	i, 395; ii, 1
Gallipolis, Ohio, ice pier (<i>see</i> Ohio River)	i, 423; ii, 1
Galveston and Brazos Canal, Tex., purchase of	i, 355; ii, 1
Galveston Bay and Harbor, Tex.:	
Defenses of, including report on damp-proofing	i, 9, 16; iv, 2
Improvement of Galveston-Texas City channel	i, 351; ii, 1
Improvement of harbor	i, 348; ii, 1
Improvement of harbor from inner bar to Fifty-first street	i, 350; ii, 1
Improvement of waterway to Houston	i, 351; ii, 1
Improvement of West Bay	i, 354, 356; ii, 1
Plan and estimate of cost of protection of harbor, etc., from storms	i, 349; ii, 1
Removal of wrecks	i, 360, 361; ii, 1
Galveston, Harrisburg and San Antonio Railway Company, bridge of	i, 647,
Gasconade River, Mo., improvement of	i, 409; ii, 1
Gauging:	
Columbia River, Oreg. and Wash.	i, 619; iii, 2
Michigan Lake, variations in surface level on east shore	i,
Mississippi River and principal tributaries	i, 405, 639; ii, 1549; S., 7, 8, 62
Northern and Northwestern Lakes, including report on outflow, rainfall, and evaporation	i, 665; iv, 2678, 2
Gauley River, W. Va., improvement of	i, 446; ii, 1
Gedney channel, New York Harbor, N. Y., improvement of	i, 139,
Genesee River, N. Y. (<i>see</i> Charlotte Harbor)	i, 567; iii, 2
George Lake, St. Johns River, Fla. (<i>see</i> Volusia bar)	i, 274; ii, 1
Georges River, Me., improvement of	i, 49,
Georgetown, D. C. <i>See</i> Washington, D. C.	
Georgetown Harbor, S. C. (<i>see</i> Winyah Bay)	i, 246; ii, 1
Gibson, Fort, Ind. T., bridge across Arkansas River near	i,
Gillen, Edward (tug), removal of wreck of	i, 129,
Glencove Harbor, N. Y., improvement of	i, 542; iii, 2
Glenifer (schooner), removal of wreck of	i, 65,
Gloucester Harbor, Mass., improvement of	i, 423; ii, 1
Golconda, Ill. (<i>see</i> Ohio River)	i, 583; iii, 2
Golden Gate, Cal., channel to Karquines Straits (<i>see</i> San Pablo Bay)	i, 170,
Goshen Creek, N. J., improvement of	i, 55,
Gosport Harbor, N. H. (<i>see</i> Isles of Shoals Harbor)	i, 673; iv, 2
Government Printing Office, Washington, D. C.:	
Construction of new building for	i, 659; iv, 2
Telegraph line	i, 659; iv, 2
Government telegraph line, Washington, D. C.	i, 659; iv, 2
Governors Island, New York Harbor, N. Y., enlargement of	i, 144,
Gowanus Bay, Canal, and Creek, N. Y.:	
Bay Ridge and Red Hook channels, including Gowanus Canal, improvement of	i, 142,
Gowanus Creek, removal of wreck	i, 145,
Gowanus Creek channel, improvement of	i, 143,
Grand Calumet River, Ill. and Ind. (<i>see</i> Calumet River)	i, 494; iii, 1

- Grand Haven Harbor, Mich.:
 Bridge across Grand River to Spring Lake i, 649
 Improvement of i, 508; iii, 1952
 Grand Marais, Mich., improvement of harbor of refuge i, 474; ii, 1824
 Grand Marais, Minn., improvement of harbor i, 464; ii, 1791
 Grand Rapids, Mich.:
 Bridge across Grand River i, 646
 Improvement of Grand River i, 509; iii, 1956
 Grand Rapids, Wabash River, lock and dam i, 457, 459; ii, 1772, 1773
 Grand River, La., improvement of i, 332; ii, 1289, 1312
 Grand River, Mich.:
 Bridge at Grand Rapids i, 646
 Bridge between Spring Lake and Grand Haven i, 649
 Improvement of i, 509; iii, 1956
 Improvement of Grand Haven Harbor i, 508; iii, 1952
 Grand River, Ohio (*see* Fairport Harbor) i, 551, 979; iii, 2084
 Grand River Toll Bridge Company, bridge of i, 649
 Grant statue, Washington, D. C. i, 658; iv, 2517
 Grant (Army transport), conversion of, into dredge i, 614, 975
 Grays Harbor, Wash.:
 Improvement of, between Aberdeen and the entrance i, 623; iii, 2327
 Improvement of, including bar entrance i, 621; iii, 2325
 Great Kanawha River, W. Va.:
 Improvement of i, 444; ii, 1721
 Operating and care of locks and dams i, 446; ii, 1723
 Great Lakes:
 Commercial statistics, Sault Ste. Marie canals, Mich i, 535; iii, 2010, 2015
 Defenses of i, 8, 9
 Dredge boat for harbors on Lake Erie. *See* Dredge boats, etc.
 Dredge boat for harbors on eastern shore of Lake Michigan i, 498, 979
 Improvement of channels in waters connecting i, 532; iii, 2001
 Outflow, rainfall, and evaporation in valley of i, 665; iv, 2855
 Survey of waters connecting lakes Superior and Huron, final report on i, 542
 Surveys and charts, with complete list of permanent and temporary
 bench marks i, 660, 665; iv, 2671, 2693
 Water levels i, 665; iv, 2678
 Water levels on east shore of Lake Michigan, variations in i, 498
 Great Pedee River, S. C., improvement of i, 245; ii, 1120
 Great Salt Pond, Block Island, R. I., improvement of i, 102, 817
 Great Sodus Bay, N. Y., improvement of harbor i, 568; iii, 2155
 Great South Bay, N. Y., improvement of i, 134, 875
 Greenbay Harbor, Fox River, Wis.:
 Harbor lines i, 640; ii, 1884
 Improvement of i, 477; ii, 1839
 Greene, Marion A. (schooner), removal of wreck of i, 228; ii, 1088
 Green Jacket shoal, Providence River, R. I., removal of i, 96, 803
 Greenleaf Bend, Mississippi River, Ill., prevention of break into Cache
 River i, 392; ii, 1455
 Green River, Ky.:
 Improvement above mouth of Big Barren River i, 461; ii, 1775
 Operating and care of locks and dams i, 461; ii, 1776
 Green Run Inlet life-saving station, Md., removal of wreck i, 194, 1023
 Greensboro, N. C., monuments to Generals Nash and Davidson in Guilford
 battle grounds near i, 676; iv, 2939
 Greenville Harbor, Miss. (*see* Mississippi River Commission) i, 639; S., 3, 40
 Greenwich Harbor, Conn., improvement of i, 121, 851
 Grounds, public buildings and, District of Columbia i, 658; iv, 2517
 Guam Island, defenses of i, 8, 9, 14, 17
 Guilford battle grounds, N. C., monuments to Generals Nash and David-
 son i, 676; iv, 2939
 Gulfport, Miss., improvement of channel to Ship Island Harbor i, 320; ii, 1266
 Gulf States:
 Removal of water hyacinths from Florida waters, including report on
 experiments made i, 279; ii, 1184; iv, 2433
 Removal of water hyacinths from Louisiana waters i, 343; ii, 1312
 Removal of water hyacinths from Texas waters i, 343
 Gun and mortar batteries i, 9, 14, 17

Gut, the, South Bristol, Me., bridge across	
Guttenberg, N. J., harbor lines in Hudson River	1, 640
Guyandot River, W. Va.:	
Bridge in Lincoln County	
Improvement of	1, 448; II,

H.

Hainesport, N. J., bridge across Rancocas River	
Hall, Willie Lee (schooner), removal of wreck of	1, 228; II,
Hampton Roads, Va.:	
Defenses of	
Improvement of	1, 221; II,
Improvement of approaches to Norfolk Harbor	1, 219; II,
Removal of wreck	1, 228; II,
Handkerchief shoal, Mass., removal of wreck	1, 108
Harbor Beach, Mich.:	
Improvement of Sandbeach harbor of refuge	1, 526; III,
Water levels at Sandbeach	1, 665; IV,
Harbor lines, establishment of	
Acushnet River, Mass., at New Bedford and Fairhaven	1, 640
Albany, N. Y.	1, 640
Allegheny River, Pa.	1, 640; II, 1708,
Arthur Kill, N. Y. and N. J., recommendation for stone monuments to mark established lines	I
Atlantic City bridge, Norfolk Harbor, Va.	1, 640; II,
Baltimore Harbor, Md., at Sparrow Point	1, 640; II,
Berrian Island, East River, N. Y.	1, 640
Brooklyn, N. Y., Newtown Creek	1, 640
China Basin, San Francisco Harbor, Cal., north of	1, 640; III,
Delaware River, between Edgemoor and Christiana River, Del.	1, 640
Duluth Harbor, Minn.	1, 640; II,
East River, N. Y., at North Brother Island, Lawrence Point, and Ber- rian Island, and between East Thirteenth and East Eighteenth streets, New York City	1, 640, 888, 891
Edgemoor, Del.	1, 640
Elizabeth, Pa.	1, 640; II,
Elizabeth River, Va.	1, 640; II,
Fairhaven Harbor, Mass.	1, 640
Fort Lee to Guttenberg, N. J.	1, 640
Fox River, Wis.	1, 640; II, 1883,
Greenbay Harbor, Wis.	1, 640; II,
Guttenberg to Fort Lee, N. J.	1, 640
Hazelwood, Pa.	1, 640; II,
Hudson River at Albany, N. Y.	1, 640
Hudson River from Fort Lee to Guttenberg, N. J.	1, 640
Jacksonville, Fla.	1, 640; II,
Kill van Kull, N. Y., recommendation for stone monuments to mark established lines along Staten Island	I
Lawrence Point, East River, N. Y.	1, 640
Lee, Fort, to Guttenberg, N. J.	1, 640
Lermonds Cove, Rockland Harbor, Me.	1, 640
Maumee River, Ohio.	1, 640; III,
Mission rock, San Francisco Harbor, Cal., north of	1, 640; III,
Mississippi River, at St. Louis, Mo.	1, 640; II,
Mississippi River, at St. Paul, Minn.	1, 640; II,
Monongahela River, Pa.	1, 640; II, 1698, 1702,
New Bedford Harbor, Mass.	1, 640
Newbern, N. C.	1, 640; II,
Newtown Creek, N. Y., east branch	1, 640
New York Harbor, East River, N. Y.	1, 640, 888, 891
New York Harbor, Hudson River from Fort Lee to Guttenberg, N. J.	1, 640
New York Harbor, Newtown Creek at Brooklyn, N. Y.	1, 640
Norfolk Harbor, Va.	1, 640; II,
North Brother Island, East River, N. Y.	1, 640
North (Hudson) River, from Fort Lee to Guttenberg, N. J.	1, 640

Harbor lines, establishment of—Continued.

Oshkosh, Wis	i, 640; ii, 1883
Patapasco River at Sparrow Point, Md.	i, 640; ii, 1033
Pawtucket (Seekonk) River, R. I	i, 640, 825
Pittsburg Harbor, Pa	i, 640; ii, 1702, 1706, 1709
Providence Harbor and River, R. I., including Pawtucket (Seekonk) River	i, 640, 825
Rockland Harbor, Me	i, 640, 727
St. Johns River, Fla	i, 640; ii, 1187
St. Louis Harbor, Mo.	i, 640; ii, 1455
St. Paul Harbor, Minn	i, 640; ii, 1513
San Francisco Harbor, Cal	i, 640; iii, 2202
Seekonk (Pawtucket) River, R. I	i, 640, 825
Smith Creek, Norfolk Harbor, Va	i, 640; ii, 1089
Sparrow Point, Patapasco River, Md	i, 640; ii, 1033
Staten Island, N. Y., recommendation for stone monuments to mark established lines along	i, 141
Superior Lake, at Duluth, Minn	i, 640; ii, 1828
Toledo Harbor, Ohio	i, 640; iii, 2107
Trent River, N. C	i, 640; ii, 1114
Wilson, Pa	i, 640; ii, 1698
Harbors and rivers. See Rivers and harbors.	
Hardings Beach light, Chatham, Mass., removal of wreck	i, 103, 820
Hargraves, R. & T. (schooner), removal of wreck of	i, 194, 1026
Harlem River, N. Y., improvement of	i, 132, 872
Harlowe Creek, N. C., improvement of waterway via	i, 235; ii, 1101
Harriman, Tenn., bridge across Emory River	i, 643
Harris, Anna M. (schooner), removal of wreck of	i, 218; ii, 1071
Harrisburg, Tex., bridge across Brays Bayou	i, 647, 648
Harris, Elsie M. (schooner), removal of wreck of	i, 194, 1023
Hartford, Conn.: Bridge across Connecticut River at	i, 644
Improvement of Connecticut River below	i, 107, 836
Hartford, W. Va., ice harbor (see Ohio River)	i, 423; ii, 1627
Harvesta chemical compound, use of	i, 279, 343; ii, 1184, 1312; iv, 2433
Hat Slough, Wash. (see Puget Sound)	i, 625; iii, 2328
Havre de Grace, Md., improvement of Susquehanna River	i, 183, 1004
Hawaiian Islands: Defenses of	i, 8, 9, 14, 17
Improvement of Pearl Harbor	i, 592; iii, 2201
Hay Lake channel, St. Marys River, Mich.: Final report on survey	i, 542
Improvement of	i, 537; iii, 2027
Improvement of channels in waters connecting Great Lakes	i, 532; iii, 2001
Hazelwood, Pa., harbor lines in Monongahela River	i, 640; ii, 1702
Helena Harbor, Ark. (see Mississippi River Commission)	i, 639; S., 3, 40
Hell Gate, East River, N. Y., improvement of	i, 131, 871
Hempstead, N. Y. (see Glencove Harbor)	i, 129, 867
Hen and Chickens light-ship, Mass., removal of wreck	i, 104, 820
Henry C. (barge), removal of wreck of	i, 194, 1024
Henry, Cape, Va., defenses at	i, 9
Herr Island, Allegheny River, Pa.: Bridge across back channel	i, 649
Lock and dam at	i, 438, 439; ii, 1680, 1683
Highway bridge across Potomac River at Washington, D. C., to replace Long Bridge	i, 643, 653; iv, 2484
Hillsboro Bay and River, Fla., improvement of	i, 285; ii, 1200
Hiwassee River, Tenn., improvement of	i, 422; ii, 1622
Hoboken, N. J., removal of wreck	i, 139, 887
Hockingport, Ohio, ice harbor in Ohio River	i, 423; ii, 1627
Hoffman Island, New York Harbor, N. Y., removal of wreck	i, 145, 925
Holland Harbor, Mich., improvement of	i, 506; iii, 1948
Holmes River, Fla., improvement of	i, 298; ii, 1222
Holston River, Va. and Tenn., improvement of	i, 423; ii, 1624
Home City, Ohio, Lock and Dam 37, Ohio River	i, 426; ii, 1645
Homochitto River, Miss., improvement of	i, 335; ii, 1299
Honolulu Harbor, Hawaii, defenses of	i, 8, 9, 14, 17

- Hookton, Cal. (*see* Humboldt Harbor)
- Hopfield Bend, Mississippi River (*see* Mississippi River)
- Houquarten Slough, Oreg. (*see* Tillamook Bay)
- Horn Island Harbor, Miss., improvement of
- Hospital Point, Norfolk Harbor, Va., removal of
- Housatonic River, Conn., improvement of
- House Committee on Rivers and Harbors. *See* Comm.
- Houston, Tex., improvement of waterway to Galveston
- Houston, Beaumont and New Orleans Railroad Company
- Howard University reservoir, Washington, D. C.
- Hudson River, N. Y. and N. J.:
 - See also* New York City and Harbor.
 - Albany, N. Y., harbor lines
 - Fort Lee to Guttenberg, N. J., harbor lines
 - Improvement of
 - Peekskill Harbor, N. Y., improvement of
 - Rondout Harbor, N. Y., improvement of
 - Saugerties Harbor, N. Y., improvement of
 - Wrecks, removal of
- Humboldt Harbor and Bay, Cal., improvement of
- Humtulsips River, Wash., bridge across
- Huntington Harbor, N. Y., improvement of
- Huron Harbor, Ohio, improvement of
- Huron Lake (*see also* Northern and Northwestern Lake Superior)
 - Final report on survey of waterway to Lake Superior
 - Improvement of harbor of refuge at Sandbeach, Minn.
 - Water levels
- Hutchinson River (East Chester Creek), N. Y., improvement of
- Hyacinths, water:
 - Removal of, from Florida waters, including reclamation made
 - Removal of, from Louisiana waters
 - Removal of, from Texas waters
- Hyannis, Mass.:
 - Improvement of harbor of refuge
 - Removal of wreck in harbor
- Hydraulic mining in California
- Hydraulics. *See* Gauging.
- Hydrology. *See* Gauging.
- Hyers Run, W. Va., bridge across Little Kanawha River

I.

- I and J streets waterway, Whatcom, Wash., bridge across
- Ida May (canal boat), removal of wreck of
- Illinois and Mississippi Canal, Ill.:
 - Construction of
 - Operating and care
- Illinois Central Railroad Company, bridge of
- Illinois River, Ill.:
 - Bridge at Chillicothe
 - Improvement of
 - Operating and care of locks and dams
 - Survey for waterway from Lockport, Ill. to Mo.
- Indiana Chute, Falls of Ohio River, improvement of
- Indian River, Fla., improvement of
- Indian River, Mich., bridge across
- Indian River Bay, Del., waterway via
- Indian River Inlet, Fla. (*see* Indian River)
- Inland waterways. *See* Canals and Waterways.
- Inside routes. *See* Canals and Waterways.
- Insley, Mary E. (schooner), removal of wreck of
- Insular possessions:
 - Defenses of
 - Improvement of Manila Harbor and Pasig River
 - Improvement of Pearl Harbor, Hawaii

Insular possessions—Continued.

- Reconnaissances and explorations in, with technical features of engineer operations in the former department of North Philippines, and present department of Luzon..... i, 668, 669, 670; iv, 2478, 2903
- Service of officers of the Corps of Engineers abroad and in the field, with troops..... i, 24
- International Commission, Permanent, of Congresses of Navigation..... i, 639
- Ironton, Ohio:
 Bridge across Ohio River to Ashland, Ky..... i, 644
 Improvement of Ohio River..... i, 423; ii, 1627
- Island possessions. *See* Insular possessions.
- Isle of Wight Bay, Md., improvement of waterway via..... i, 180, 1002
- Isles of Shoals, Me., improvement of harbor at..... i, 55, 733
- Istokpoga Creek, Fla. (*see* Kissimmee River)..... i, 281; ii, 1193

J.

- Jackson, Ky., bridge across North Fork, Kentucky River..... i, 645
- Jackson, Lansing and Saginaw Railroad Company, bridge of..... i, 648
- Jacksonville, Fla.:
See also St. Johns River.
 Harbor lines in St. Johns River..... i, 640; ii, 1187
- James River, Va.:
 Improvement of..... i, 216; ii, 1065
 Protection of Jamestown Island..... i, 218; ii, 1071
- Jamestown Island, James River, Va., protection of..... i, 218; ii, 1071
- Jefferson, Tex., waterway to Shreveport, La. (*see* Cypress Bayou) ... i, 365; ii, 1372
- Jekyl Creek, Ga., improvement of waterway via..... i, 269; ii, 1166
- Jersey Central Traction Company, bridge of..... i, 650
- Johnsons Bayou, La., improvement of..... i, 343; ii, 1311
- Johnsons Creek or River, Conn. (*see* Bridgeport Harbor)..... i, 115, 846
- J street waterway, Whatcom, Wash., bridge across..... i, 645, 646
- Judith Point, R. I.:
 Construction of harbor of refuge, with report on easterly detached breakwater..... i, 99, 807, 809
 Improvement of pond entrance..... i, 100, 814
- Jupiter Inlet, Fla. (*see* Indian River)..... i, 277; ii, 1181
- Justice, Department of. *See* Attorney-General.

K.

- Kalamazoo River, Mich., improvement of..... i, 504; iii, 1945
- Kampsville lock and dam, Illinois River, Ill., operating and care ... i, 496; iii, 1917
- Kanawha River, W. Va.:
 Improvement of..... i, 444; ii, 1721
 Operating and care of locks and dams..... i, 445; ii, 1723
- Kansas City Southern Railway Company, bridge of..... i, 646
- Karquines Straits, Cal., channel to the Golden Gate (*see* San Pablo Bay) i, 583; iii, 2189
- Kenduskeag River, Me. (*see* Penobscot River)..... i, 43, 717
- Kennebec River, Me.:
 Defenses of, including report on telephone booths and damp-proofing..... i, 9; iv, 2371
 Improvement of..... i, 50, 724
- Kennebunk River, Me., improvement of..... i, 55
- Kennerdell, Pa., bridge across Allegheny River..... i, 647
- Kenosha Harbor, Wis., improvement of..... i, 487; ii, 1863
- Kentucky Lumber and Veneer Company, bridge of..... i, 645
- Kentucky, River, Ky.:
 Bridge across North Fork below Jackson..... i, 645
 Improvement of..... i, 450; ii, 1748
 Operating and care of locks and dams..... i, 451; ii, 1753
- Keokuk, Iowa. *See* Mississippi River.
- Kerrs Run, Ohio, ice harbor in Ohio River..... i, 423; ii, 1627
- Kewaunee Harbor, Wis., improvement of..... i, 481; ii, 1848

- Keweenaw Bay, Mich.:
 Waterway to Lake Superior, improvement and care..... I, 471, 472; I
 Waterway to Lake Superior, removal of wreck I, 475; I
 Keyport Harbor, N. J., improvement of I, 11
 Key West Harbor, Fla.:
 Defenses of, including report on damp-proofing I, 9; II
 Improvement of, including dredge construction I, 278, 980; I
 Removal of wrecks I, 281; I
 Kill van Kull, N. Y. and N. J.:
 Improvement of Staten Island-New Jersey channel I, 1
 Recommendation for stone monuments to mark established harbor
 lines along Staten Island I, 1
 Kingston Bay, Mass. (*see* Duxbury Harbor) I, 1
 Kingston, R. I.:
 Construction of Point Judith harbor of refuge, with report on easterly
 detached breakwater I, 99, 10
 Improvement of entrance to Point Judith Pond I, 10
 Kingsville, S. C., bridge across Wateree River at I, 10
 Kinnickinnick River, Wis. (*see* Milwaukee Harbor) I, 485; II
 Kissimmee Lake and River, Fla., improvement of I, 281; II
 Knox and Lincoln Branch, Maine Central Railroad Company, bridge across
 Marsh River I, 1
 Knoxville, Lafollette and Jellico Railroad Company, bridge of I, 1

L.

- La Crosse Harbor, Wis., improvement of I, 396; II
 Laffrinier, Ira (schooner), removal of wreck of I, 8
 Lafourche Basin leveeboard of Louisiana, lock and dam in Bayou Lafourche.
 Lafourche Bayou, La.:
 Construction of lock and dam by the Atchafalaya Basin and Lafourche
 Basin levee boards I, 330; II
 Improvement of I, 330; II
 Lagrange Bayou, Fla., improvement of I, 298; II
 Lagrange lock and dam, Illinois River, Ill., operating and care I, 496; III
 Lakes, department of the, reconnaissances and explorations I, 668; IV
 Lakes Ditch, Atlantic City, N. J., bridge across I, 668; IV
 Lakes, Great. *See* Great Lakes.
 Lake Washington Canal, Wash. *See* Puget Sound.
 Lamb, L. L. (barge), removal of wreck of I, 556; III
 Lambs, S. C., removal of wreck in Ashley River I, 257; II
 Lamprey River, N. H. (*see* Cochecho River) I, 5
 L'Anguille River, Ark., improvement of I, 387; II
 Larabee Landing, Lake Champlain, Vt., removal of wrecks near I, 7
 Larchmont Harbor, N. Y., improvement of I, 15
 La Trappe River, Md., improvement of I, 191
 Lawrence Point, East River, N. Y., harbor lines I, 64
 Laws of 57th Congress, second session, affecting Corps of Engineers IV
 Leaf River, Miss., improvement of I, 319; II
 Leakesville, Miss., bridge across Chickasahay River I, 319; II
 Leavenworth, Fort, Kans.:
 Engineer depot at I, 21, 2
 Engineer troops at I, 21, 2
 Leech Lake, Minn.:
 Construction of reservoir dam I, 398; II
 Operating and care of reservoir dam I, 399; II
 Lee County, Fla., bridge of I, 399; II
 Lee, Fort, N. J., harbor lines in Hudson River I, 64
 Lee Slough, Apalachicola River, Fla., improvement of I, 292; II
 Legislation of 57th Congress, second session, affecting Corps of Engineers IV
 Leipsic River, Del., removal of wreck I, 194
 Lemon Creek, N. Y. (*see* Staten Island-New Jersey channel) I, 14
 Leonardtown Harbor, Md. (*see* Breton Bay) I, 201; II, 1044
 Leon County, Fla., bridge of I, 201; II, 1044
 Lermonds Cove, Rockland Harbor, Me., harbor lines I, 64
 Levels, water. *See* water-level observations.

- Levisa Fork, Big Sandy River, Ky.:
 Bridge near Whitehouse i, 647
 Improvement of i, 418; ii, 1742
- Lewes, Del.:
 Improvement of waterway to Chincoteague Bay, Va i, 180, 1002
 Iron pier in Delaware Bay near, maintenance and repair of i, 163, 968
- Lewis and Clark River, Oreg., bridge across i, 649
- Lewis River, Wash., improvement of i, 618; iii, 2319
- Lichtenfels Bros. (barge), removal of wreck of i, 145, 924
- Lincoln, Abraham, proposed monument to i, 658; iv, 2565
- Lincoln County, W. Va., bridge of i, 646
- Little Assawaman Bay, Del., waterway via i, 180, 1002
- Little Calumet River, Ill., bridge at Chicago i, 647
- Little Creek, Del., removal of wrecks i, 194, 1023
- Little D'Arbonne Bayou, La. (*see* D'Arbonne Bayou) i, 368, 370; ii, 1379
- Little Duck Creek (Leipsic River), Del., removal of wreck i, 194, 1025
- Littlefalls, Minn., bridge of city of, across Mississippi River i, 642
- Little Harbor, N. H., improvement of harbor of refuge i, 58, 736
- Little Kanawha Railroad Company, bridges of i, 650
- Little Kanawha River, W. Va.:
 Bridge at Hyers Run i, 649
 Bridges in Wirt, Calhoun, Gilmer, and Braxton counties i, 650
 Improvement of i, 443; ii, 1718
 Operating and care of lock and dam i, 444; ii, 1719
- Little Mud River, Ga., improvement of waterway via i, 269; ii, 1166
- Little Myro (schooner), removal of wreck of i, 194, 1024
- Little Narragansett Bay, R. I. and Conn. (*see* Pawcatuck River) i, 104, 831
- Little Pedee River, S. C., improvement of i, 244; ii, 1119
- Little Pigeon River, Tenn., improvement of i, 421; ii, 1616
- Little River, Ark., bridge near White Cliffs i, 646
- Little River, La. (part of Red River), improvement of i, 361; ii, 1363
- Little River, La. (tributary of Red River), bridge near Simmons Ferry i, 650
- Little Sarasota Bay, Fla., improvement of i, 284; ii, 1197
- Little Sodus Bay, N. Y., improvement of harbor i, 569; iii, 2157
- Little Tallahatchie River, Miss. (*see* Tallahatchie River) i, 373; ii, 1396
- Livingston (schooner), removal of wreck of i, 271; ii, 1171
- Lockport, Ill., survey for waterway to St. Louis, Mo. i, 494, 639; iii, 1904; S., 7, 68, 167
- Locks. *See* Canals and Waterways.
- Lockwood (steamer), removal of wreck of i, 556; iii, 2106
- Lone Tree Point, Cal. (*see* San Pablo Bay) i, 583; iii, 2189
- Long Bridge, Potomac River, Washington, D. C., highway bridge to replace i, 643, 653; iv, 2484
- Long Island Sound, defenses of eastern entrance, including report on damp-proofing i, 9; iv, 2387
- Long Sault Island, St. Lawrence River, N. Y., improvement at head of i, 574; iii, 2168
- Long Tom River, Oreg., improvement of i, 609; iii, 2257
- Lorain Harbor, Ohio:
 Bridge across Black River i, 645
 Improvement of i, 547; iii, 2066
 Removal of wreck i, 556; iii, 2104
- Louis Bayou, La., bridge across i, 646
- Louisiana, State of:
 Atchafalaya Basin and Lafourche Basin levee boards' lock and dam in Bayou Lafourche i, 641
 Removal of water hyacinths from waters in, including report on experiments made in the Florida district i, 343; ii, 1312; iv, 2433
 Rice Irrigation and Improvement Association's lock and dam in Mermentau River i, 641
- Louisiana and Arkansas Railroad Company, bridge of i, 650
- Louisiana Western Railroad, bridge across Calcasieu River, La i, 648
- Louisville and Portland Canal, Ky.:
 Enlargement of i, 452; ii, 1763
 Operating and care i, 455; ii, 1765
- Loutre, Pass a, Mississippi River, La.:
 Closing crevasse in i, 324; ii, 1275
 Constructing sill across i, 325; ii, 1276

Lower Machodoc Creek, Va., improvement of	i, 206; ii, 1055
Lubec channel, Me., improvement of	i, 37, 712
Ludington Harbor, Mich., improvement of	i, 514; iii, 1966
Luling, Chas. (schooner), removal of wreck of	iii, 2047
Lumberton Branch, Rancocas River, N. J., improvement of	i, 166, 984
Luzon, department of, reconnaissances and explorations, including technical details of engineer operations	i, 667, 669; iv, 2478, 2903
Lynn Harbor, Mass.:	
Bridge across Saugus River to Revere	i, 650
Improvement of	i, 73, 759

M.

McClellan statue, Washington, D. C.	i, 658; iv, 2517
McClellanville, S. C., improvement of waterway to Charleston, with estimates of cost	i, 252; ii, 1132
McKees Rocks, Pa., bridge across Ohio River to Allegheny	i, 644
Mackinac Straits, Mich., removal of wreck in	i, 542; iii, 2046
McKinley, Fort William, Manila Bay, P. I.	iv, 2481, 2907
Maçon Bayou, La., improvement of	i, 368, 370; ii, 1379
Maine Central Railroad Company, bridge of	i, 649
Maine, defenses of coast, including report on telephone booths and damp-proofing	i, 9; iv, 2371
Main Ship channel, New York Harbor, N. Y.:	
Improvement of	i, 139, 909
Removal of wrecks	i, 145, 924, 925
Malden River, Mass.:	
Bridge between Everett and Medford	i, 650
Improvement of	i, 75, 761
Mall, the, Washington, D. C.	i, 658; iv, 2517
Mamaroneck Harbor, N. Y., improvement of	i, 124, 859
Manasquan River, N. J., improvement of	i, 157, 953
Manatee River, Fla.:	
Bridge at Craigs Point	i, 643
Improvement of	i, 287; ii, 1202
Manchac Bayou, La., improvement of	i, 338; ii, 1305
Manchac Pass, La., bridge in St. John the Baptist Parish	i, 645
Manchester Harbor, Mass., improvement of	i, 67, 745
Manila Bay and Harbor, P. I.:	
Defenses of	i, 8, 9, 14, 17
Improvement of	i, 670; iv, 2903, 2910
Reconnaisances and explorations in the former department of North Philippines, and present department of Luzon, with technical details of engineer operations	i, 668, 669; iv, 2478, 2903
Manisees (U. S. steamer), removal of wrecks and other obstructions by ..	i, 145, 925
Manistee Harbor, Mich., improvement of	i, 516; iii, 1970
Manitowoc Harbor and River, Wis.:	
Alleged shoal in Lake Michigan, south of	i, 665; iv, 2883
Improvement of	i, 482; ii, 1851
Survey of	i, 483; ii, 1880
Manokin River, Md., improvement of	i, 193, 1022
Manson, Agnes E. (schooner), removal of wreck of	i, 103, 820
Mantua Creek, N. J., improvement of	i, 168, 987
Maps:	
Land within flats of Anacostia River, D. C.	i, 36
Military and other	i, 667, 673; iv, 2478, 2899
Northern and Northwestern Lakes	i, 660, 665; iv, 2671
Marblehead Harbor, Mass.:	
Repair of sea wall	i, 68, 747
Survey for breakwater	i, 69, 753
Marcushook, Pa., improvement of ice harbor	i, 166, 984
Marine City, Mich., removal of wreck near	iii, 2047
Marinette, Wis. (see Menominee River)	i, 475; ii, 1834
Marion County, W. Va., bridge of	i, 651
Market Street Elevated Passenger Railway Company, bridge of	i, 648

Marquette Bay and Harbor, Mich.:

- Construction of harbor of refuge in bay i, 474; ii, 1823
- Improvement of harbor i, 473; ii, 1820
- Water levels i, 665; iv, 2678

Marriot (schooner), removal of wreck of i, 103, 820**Marsh River, Me., bridge at Newcastle** i, 649**Marthas Vineyard, Mass., improvement of Vineyard Haven Harbor** i, 90, 791**Martin (schooner), removal of wreck of** iii, 2047**Massachusetts, State of:****Bridge of, across Malden River between Everett and Medford** i, 650**Bridge of, across Saugus River between Revere and Lynn** i, 650**Matanzas River, Fla. (see St. Augustine Harbor)** i, 275; ii, 1181**Matawan Creek, N. J., improvement of** i, 152, 941**Mathews, Dora (schooner), removal of wreck of** i, 103, 820**Mattaponi River, Va., improvement of** i, 214; ii, 1063**Maumee Bay and River, Ohio:****Harbor lines in river at Toledo** i, 640; iii, 2107**Improvement of Toledo Harbor, including dredge construction** i, 542, 979; iii, 2049**Removal of wreck in bay** i, 557; iii, 2106**May, Ida (canal boat), removal of wreck of** i, 194, 1023**Medford, Mass., bridge across Malden River to Everett** i, 650**Meerwald, Mary W. (sloop), removal of wreck of** i, 165, 971**Memorials, statues, etc.:****In public grounds, Washington, D. C.** i, 658; iv, 2517**Memorial Bridge, Washington, D. C.** i, 653; iv, 2484**Monuments to Gens. Francis Nash and William Lee Davidson** i, 676; iv, 2939**Memphis Harbor, Tenn. (see Mississippi River Commission)** i, 639; s., 3, 40**Memphis, Helena and Louisiana Railway Company:****Bridge of, across St. Francis River, Ark.** i, 644**Bridges of, across White and Arkansas rivers, Ark.** i, 643**Menekaunee, Wis. (see Menominee River)** i, 475; ii, 1834**Menominee Harbor and River, Mich. and Wis., improvement of** i, 475; ii, 1834**Menominee River, Milwaukee, Wis.:****Bridges at West Water street** i, 649**Improvement of Milwaukee Harbor** i, 485; ii, 1857**Mercer, Gen. Hugh, monument to** i, 658; iv, 2517**Mermentau River, La.:****Construction of lock and dam by the Rice Irrigation and Improvement****Association** i, 641**Improvement of, including tributaries** i, 340; ii, 1308**Merrimac River, Mass.:****Improvement of** i, 60, 738**Improvement of Newburyport Harbor** i, 59, 737**Methods, engineering, technical details of. See Technical details.****Metropolitan Park Commission of Massachusetts, bridge of** i, 650**Metuchen, N. J., removal of wreck in Raritan River** i, 159, 955**Mexico, Gulf of:****Removal of water hyacinths from Florida tributaries, including report on experiments made** i, 279; ii, 1184; iv, 2433**Removal of water hyacinths from Louisiana tributaries** i, 343; ii, 1312**Removal of water hyacinths from Texas tributaries** i, 343**Miami Harbor and River, Fla.:****Bridge of Dade County at Avenue D** i, 646**Bridge of Florida East Coast Railway Company** i, 648**Improvement of Biscayne Bay** i, 277; ii, 1182**Mianus River, Conn., improvement of** i, 122, 854**Michigan Central Railroad Company:****Bridge of, across Indian River, Mich.** i, 648**Bridge of, across Little Calumet River, Ill.** i, 647**Michigan City, Ind.:****Improvement of inner harbor** i, 498; iii, 1931**Improvement of outer harbor** i, 498, 499; iii, 1931**Michigan Lake (see also Northern and Northwestern Lakes):****Alleged shoal south of Manitowoc Harbor, Wis.** i, 665; iv, 2883**Canal to Sturgeon Bay, improvement of, including harbor of refuge** i, 478; ii, 1841

Michigan Lake—Continued.

- Canal to Sturgeon Bay, operating and care
- Dredge boat for harbors on eastern shore
- Reef off Wind Point, near Racine Harbor, Wis.
- Water levels
- Water levels on east shore, variations in
- Michigan Lake Superior Power Company's canal at Saul
- Middle Island light-house, Lake Erie, removal of wreck
- Middle Neebish channel, St. Marys River, Mich., impro
- Middleport, Ohio, ice pier (*see* Ohio River)
- Milan, Ill.:
 - Construction of canal around Rock River at
 - Operating and care of canal around Rock River at ..
- Milford Harbor, Conn., improvement of
- Milford Haven, Va., improvement of harbor at
- Military reconnaissances and explorations, with report o
- of engineer operations in the former department of
- and present department of Luzon
- Miller Bay, Lake Winnebago, Wis. (*see* Fox River)
- Mill River, New Haven, Conn., improvement of
- Mill River, Stamford, Conn. (*see* Stamford)
- Milwaukee Bay, Harbor, and River, Wis.:
 - Bridges across Menominee River at West Water str ..
 - Improvement of
 - Water levels
- Mindanao, department of, reconnaissances and explorati
- Miner, Bertha (barge), removal of wreck of
- Mines, submarine
- Minim Creek-Estherville Canal, S. C. (*see* Santee River
- Mining casemates
- Mining, hydraulic, in California
- Minneapolis, Minn.:
 - See also* Mississippi River.
 - Bridge at Fifth avenue across slough at Boom Island ..
- Minneapolis, Superior, St. Paul and Winnipeg Railway C
- Minnesota River, Minn.:
 - Improvement of
 - Survey of Big Stone Lake and Lake Traverse for re ..
- Mispillion River, Del., improvement of
- Mission rock, San Francisco Harbor, Cal., harbor lines r ..
- Mississippi River:
 - Anoka, Minn., bridge at
 - Beechridge, Ill., prevention of break at
 - Boom Island, Minneapolis, Minn., bridge across slo ..
 - Brainerd to Grand Rapids, Minn., improvement from ..
 - Caruthersville, Mo. (*see* Mississippi River Commissi ..
 - Delta Point, La. (*see* Mississippi River Commission) ..
 - Des Moines Rapids Canal, examination for enlargem ..
 - estimates of cost, and for dam at foot of rapids.
 - Des Moines Rapids Canal and dry dock, operating a ..
 - Dredge and snag boats above Missouri River, operat ..
 - Dredge and snag boats below Missouri River, operat ..
 - Dredge boats for outlet of
 - Gauging, including principal tributaries 1, 40
 - Grand Rapids to Brainerd, Minn., improvement from ..
 - Greenleaf Bend, Ill., prevention of break into Cache ..
 - Greenville, Miss. (*see* Mississippi River Commission) ..
 - Head of Passes to headwaters, surveys from
 - Head of Passes to Ohio River, improvement, survey ..
 - Helena, Ark. (*see* Mississippi River Commission)
 - Hopefield Bend (*see* Mississippi River Commission) ...
 - Illinois and Mississippi Canal, Ill., construction of ..
 - Illinois and Mississippi Canal, Ill., operating and ca ..
 - La Crosse Harbor, Wis., improvement of
 - Littlefalls, Minn., bridge of city of
 - Loutre, Pass a, La., closing crevasse in
 - Loutre, Pass a, La., constructing sill across
 - Memphis, Tenn. (*see* Mississippi River Commission) ..
 - Minneapolis, Minn., bridge at Boom Island

Mississippi River—Continued.

- Minneapolis, Minn., to St. Paul, improvement from..... i, 396; ii, 1523
 Missouri River, above, operation of snag and dredge boats..... i, 393; ii, 1463
 Missouri River, below, removal of snags and wrecks..... i, 389; ii, 1441
 Missouri River to Ohio River, improvement from..... i, 390; ii, 1445
 Missouri River to St. Paul, Minn., improvement from..... i, 393; ii, 1468
 Natchez, Miss. (*see* Mississippi River Commission)..... i, 639; S., 3, 40
 New Orleans, La., defenses of, including report on damp-proofing.. i, 9; iv, 2415
 New Orleans, La., improvement at, by Mississippi River Commission..... i, 639; S., 3, 40
 Ohio River to Head of Passes, improvement, surveys, etc..... i, 639; S., 3, 40
 Ohio River to Missouri River, improvement from..... i, 390; ii, 1445
 Outlet, improvement of..... i, 325, 973; ii, 1276
 Pass a Loutre, La., closing crevasse in..... i, 324; ii, 1275
 Pass a Loutre, La., constructing sill across..... i, 325; ii, 1276
 Passes of, dredge boats for..... i, 325, 326, 973, 980; ii, 1276, 1277
 Plaquemine Bayou, La., construction of lock..... i, 332; ii, 1289
 Pokegama Falls, Minn., construction of reservoir dam..... i, 398; ii, 1528
 Pokegama Falls, Minn., operating and care of reservoir dam... i, 399; ii, 1538
 Reservoir dams at headwaters, construction of..... i, 398; ii, 1528
 Reservoir dams at headwaters, operating and care..... i, 399; ii, 1538
 St. Louis, Mo., harbor lines..... i, 640; ii, 1455
 St. Louis, Mo., to Lockport, Ill., survey for waterway..... i, 494, 639; iii, 1904; S., 7, 68, 167
 St. Paul, Minn., gauging..... i, 405; ii, 1549
 St. Paul, Minn., harbor lines..... i, 640; ii, 1513
 St. Paul, Minn., to Minneapolis, improvement from..... i, 396; ii, 1523
 St. Paul, Minn., to Missouri River, improvement from..... i, 393; ii, 1468
 Snag and dredge boats above Missouri River, operation of..... i, 393; ii, 1463
 Snags and wrecks below Missouri River, removal of..... i, 389; ii, 1441
 South Pass, examinations and surveys..... i, 328; ii, 1278
 South Pass, maintenance of channel..... i, 328; ii, 1279
 Southwest Pass, improvement of, including dredge construction..... i, 326, 980; ii, 1277
 Vicksburg Harbor, Miss., improvement of..... i, 370; ii, 1385
 Vidalia, La. (*see* Mississippi River Commission)..... i, 639; S., 3, 40
 Water-level observations on, including tributaries. i, 405, 639; ii, 1549; S., 7, 8, 62, 97
 Wrecks, etc., above Missouri River, removal of..... i, 393; ii, 1463
 Wrecks, etc., below Missouri River, removal of..... i, 389; ii, 1441
Mississippi River Commission:
 Improvement of Mississippi River..... i, 639; S., 3, 40
 Survey for waterway from Lockport, Ill., to St. Louis, Mo..... i, 494, 639; iii, 1904; S., 7, 68, 167
Mississippi Sound, Miss.:
 Improvement of Gulfport-Ship Island Harbor channel..... i, 320; ii, 1266
 Improvement of Horn Island Harbor..... i, 315; ii, 1258
Missouri, department of the, reconnaissances and explorations .. i, 668, 671; iv, 2914
Missouri River:
 Bridge between Cass County, Nebr., and Mills County, Iowa..... i, 644
 Bridge between Council Bluffs, Iowa, and East Omaha, Nebr..... i, 642
 Improvement of, with technical details concerning dike and revetment construction..... i, 405; ii, 1551; iv, 2437
Mobile Harbor and River, Ala.:
 Defenses of, including report on damp-proofing..... i, 9; iv, 2414
 Improvement of..... i, 307; ii, 1237
 Removal of sunken pontoons in river..... i, 324; ii, 1272
Moccasin River (Contentnia Creek), N. C., improvement of..... i, 232; ii, 1096
Mokelumne River, Cal.:
 Bridge near mouth of Snodgrass Slough..... i, 646
 Improvement of..... i, 586; iii, 2193
Monomoy Point, Mass., removal of wrecks off..... i, 103, 819, 820
Monongahela River, W. Va. and Pa.:
 Bridge at Fairmont, W. Va..... i, 651
 Harbor lines from Wilson to Elizabeth, at Hazelwood, and below Smithfield Street Bridge, Pittsburg, Pa..... i, 640; ii, 1698, 1702, 1706
 Improvement at Locks 2, 3, and 6..... i, 429; ii, 1658
 Improvement of, between Morgantown and Fairmont, W. Va... i, 427; ii, 1652

Monongahela River, W. Va. and Pa.—Continued.

Improvement of Pittsburg Harbor	i, 432; ii,
Operating and care of locks and dams	i, 431; ii,
Monroe Harbor, Mich., improvement of	i, 528; iii,
Monroe Lake, St. Johns River, Fla. (<i>see</i> Volusia bar)	i, 274; ii,
Monuments, statues, etc.:	
In public grounds, Washington, D. C.	i, 658; iv,
Memorial Bridge, Washington, D. C.	i, 653; iv,
To Gens. Francis Nash and William Lee Davidson	i, 676; iv,
Morgan Canal, Tex.:	
Improvement of (<i>see</i> Galveston ship channel)	i, 351; ii,
Operating and care	i, 353; ii,
Mormon channel, San Joaquin River, Cal.:	
Bridge at Stockton	i
Improvement of	i, 584, 585; iii, 2190,
Mortar batteries	i, 9, i
Mosher, Amorette (schooner), removal of wreck of	i, 556; iii,
Mosquito Creek Canal, S. C. (<i>see</i> Santee River)	i, 248; ii,
Mound City, Ill. (<i>see</i> Ohio River)	i, 423; ii,
Mount Desert, Bar Harbor, Me., construction of breakwater	i, 39
Mount Holly Branch, Rancocas River, N. J., improvement of	i, 166
Mount Hope Bay, Mass. (<i>see</i> Fall River Harbor)	i, 97
Mount Pleasant shore, Charleston, S. C., improvement at	i, 253; ii,
Mount Rainier National Park, Wash., survey for road	
Mud Lake, La. (<i>see</i> Mermentau River)	i, 340; ii,
Mud River, Ga., improvement of waterway via	i, 269; ii,
Mud River, S. C. (<i>see</i> Savannah-Beaufort waterway)	i, 257; ii,
Murderkill River, Del., improvement of	i, 176
Muscle Shoals Canal, Tennessee River, Ala.:	
Construction of	i, 417; ii,
Operating and care	i, 419; ii,
Muskegon Harbor, Mich., improvement of	i, 510; iii,
Muskingum River, Ohio:	
Improvement of	i, 446; ii,
Operating and care of locks and dams	i, 447; ii,
Myro, Little (schooner), removal of wreck of	i, 194,
Mystic River, Mass.:	
Improvement of	i, 75
Improvement of, below mouth of Island End River	i, 76

N.

Nandua Creek, Va., improvement of	i, 207; ii,
Nansemond River, Va., improvement of	i, 222; ii,
Nanticoke River, Del. and Md., improvement of	i, 192,
Nantucket, Mass., construction of harbor of refuge at	i, 89
Nantucket Sound, Mass., removal of wrecks	i, 103, 819
Napa River, Cal., improvement of	i, 590; iii,
Narragansett Bay, R. I.:	
Defenses of, including report on foundations, damp-proofing, and painting of concrete	i, 9; iv,
Improvement of	i, 95
Narraguagus River, Me., improvement of	i, 38
Narrows of Lake Champlain, N. Y. and Vt.:	
Improvement of	i, 72
Removal of wrecks	i, 73
Nasel River, Wash. (<i>see</i> Willapa River)	i, 620; iii,
Nash, Gen. Francis, monument to	i, 676; iv,
Nashville Terminal Company, bridge of	i
Natalbany River, La. (<i>see</i> Tickfaw River)	i, 338; ii,
Natchez Bay, La. (<i>see</i> Bayou Plaquemine)	i, 332; ii, 1289,
Natchez Harbor, Miss. (<i>see</i> Mississippi River Commission)	i, 639; S.,
National parks. <i>See</i> Parks.	
Nauset Harbor, Mass., removal of wreck	i, 88
Navesink River, N. J. (<i>see</i> Shrewsbury River)	i, 155
Navigable waters. <i>See</i> Bridges, Rivers and harbors, and Wrecks.	
Navigation, Congresses of, Permanent International Commission	i
Neches River, Tex., improvement of	i, 344; ii,
Neebish channels, St. Marys River, Mich., improvement of	i, 537; iii,

- Negro Cut, Indian River Inlet, Fla. (*see* Indian River) I, 276; II, 1181
- Neshaminy Creek, Pa., bridge near Croydon I, 646
- Nettie (sloop), removal of wreck of I, 194, 1023
- Neuse River, N. C.:
 Improvement of I, 223; II, 1097
 Improvement of waterway between Newbern and Beaufort. I, 235; II, 1101
- Newark, N. J.:
 Improvement of Passaic River I, 145, 927
 Removal of wreck in Passaic River I, 159, 955
- Newark Bay, N. J.:
 Improvement of (*see* Arthur Kill) I, 148, 932
 Improvement of (*see* Passaic River) I, 145, 927
 Removal of wrecks I, 158, 159, 954, 955
- New Bedford Harbor, Mass.:
 Defenses of I, 9
 Harbor lines I, 640, 820
 Improvement of I, 92, 794
- Newbern, N. C.:
 Harbor lines in Trent River I, 640; II, 1114
 Improvement of Neuse River I, 233; II, 1097
 Improvement of Trent River I, 234; II, 1099
 Improvement of waterway to Beaufort, N. C. I, 235; II, 1101
- Newburgh and South Shore Railway Company, bridge of I, 650
- Newburyport Harbor, Mass., improvement of I, 59, 737
- Newcastle, Me., bridge across Marsh River I, 649
- New Haven Harbor, Conn.:
 Bridge across West River at Kimberly avenue I, 651
 Construction of breakwaters I, 112, 842
 Improvement of, by dredging I, 110, 839
- New Jersey-Staten Island channel:
 Improvement of I, 147, 932
 Removal of wrecks in Arthur Kill I, 158, 159, 955, 956
- New London Harbor, Conn.:
 Bridge across Smiths Cove, Thames River I, 652
 Improvement of I, 105, 833
- New London Northern Railroad Company, bridge of I, 652
- New Orleans Harbor, La.:
 Defenses of, including report on damp-proofing I, 9; IV, 2415
 Improvement of (*see* Mississippi River Commission) I, 639; S., 3, 40
- Newport Bridge, Belt and Terminal Railway Company, bridge of I, 642
- Newport Harbor, Ark., bridge across White River I, 642
- Newport Harbor, R. I., improvement of I, 98, 805
- Newport News Point, Hampton Roads, Va., removal of wreck I, 228; II, 1088
- Newport River, N. C.:
 Improvement of Beaufort Harbor I, 236; II, 1102
 Improvement of waterway between Beaufort and New River I, 236; II, 1103
 Improvement of waterway between Newbern and Beaufort. I, 235; II, 1101
- New River, N. C.:
 Improvement of I, 237; II, 1104
 Improvement of waterway to Beaufort I, 236; II, 1103
- New Rochelle, N. Y. (*see* Echo Bay Harbor) I, 126, 861
- New Shoreham, Block Island, R. I.:
 Construction of harbor of refuge I, 101, 815
 Improvement of Great Salt Pond I, 102, 817
- Newtown Creek, N. Y.:
 Harbor lines in east branch at Brooklyn I, 640, 898
 Improvement of I, 133, 873
- New Whatcom Harbor, Wash.:
 Bridge across I and J streets waterway I, 645, 646
 Bridge across Whatcom Creek waterway I, 647
 Improvement of I, 634; III, 2337
- New York, Chicago and St. Louis Railroad Company:
 Bridge of, across Black River, Ohio I, 645
 Bridge of, across Calumet River, Ill. I, 643, 644
- New York City and Harbor, N. Y.:
 Ambrose channel, improvement of, including dredge construction. I, 139, 909, 979
 Arthur Kill, improvement of I, 147, 932

New York City and Harbor, N. Y.—Continued.

Arthur Kill, recommendation for stone monuments to mark established harbor lines	i, 1
Arthur Kill, removal of wrecks	i, 158, 159, 955, 9
Battery, the, removal of shoal off Pier A	i, 140, 8
Bay Ridge channel, improvement of	i, 142, 8
Bayside channel, improvement of	i, 139, 8
Berrian Island, East River, harbor lines	i, 640, 8
Bronx River, improvement of	i, 126, 8
Bronx River, removal of wrecks	i, 138, 139, 8
Buttermilk channel, improvement of	i, 143, 8
Buttermilk channel, removal of obstruction	i, 145, 8
Defenses of, including report on damp-proofing	i, 9, 14, 16; iv, 2
East (Ambrose) channel, improvement of	i, 139, 909, 8
East Chester Bay, bridge in Pelham Bay Park	i, 6
East Chester Creek, improvement of	i, 126, 8
East River, harbor lines at North Brother Island, Lawrence Point, and Berrian Island, and between East Thirteenth and East Eighteenth streets	i, 640, 888, 891, 8
East River, improvement of	i, 131, 8
East River, removal of wreck	i, 139, 8
Engineer depot	i, 21, 23, 7
Flushing Bay, improvement of	i, 129, 8
Fort Lee, N. J., harbor lines in Hudson River to Guttenberg	i, 640, 8
Fort Totten, building for School of Submarine Defense	i, 13, 8
Gedney channel, improvement of	i, 139, 8
Governors Island, enlargement of	i, 144, 8
Gowanus Bay and Canal, improvement of	i, 142, 8
Gowanus Creek, removal of wreck	i, 145, 8
Gowanus Creek channel, improvement of	i, 143, 8
Harlem River, improvement of	i, 132, 8
Hell Gate, East River, improvement of	i, 131, 8
Hoffman Island, removal of wreck	i, 145, 8
Hudson River, harbor lines from Fort Lee to Guttenberg, N. J.	i, 640, 8
Hudson River, removal of wreck near Hoboken, N. J.	i, 139, 8
Hudson River, removal of reef off Pier A, North River	i, 140, 8
Improvement of, including dredge construction	i, 139, 909, 8
Kill van Kull, improvement of Staten Island-New Jersey channel	i, 148, 8
Kill van Kull, recommendation for stone monuments to mark established harbor lines along Staten Island	i, 1
Lawrence Point, East River, harbor lines	i, 640, 8
Lee, Fort, N. J., harbor lines in Hudson River to Guttenberg	i, 640, 8
Lemon Creek (<i>see</i> Staten Island-New Jersey channel)	i, 148, 8
Main Ship channel, improvement of	i, 139, 8
Main Ship channel, removal of wrecks	i, 145, 924, 8
Newark Bay, improvement of (<i>see</i> Passaic River)	i, 145, 8
New Jersey-Staten Island channel, improvement of	i, 148, 8
Newtown Creek, harbor lines in east branch, at Brooklyn	i, 640, 8
Newtown Creek, improvement of	i, 133, 8
North Brother Island, East River, harbor lines	i, 640, 8
North (Hudson) River, harbor lines from Fort Lee to Guttenberg, N. J.	i, 640, 8
North (Hudson) River, removal of reef off Pier A	i, 140, 8
North (Hudson) River, removal of wrecks	i, 139, 8
Pelham Bay Park, bridge across East Chester Bay	i, 6
Red Hook channel, improvement of	i, 142, 8
Southwest Spit, removal of obstructions	i, 145, 8
Spuytten Duyvil Creek (<i>see</i> Harlem River)	i, 132, 8
Staten Island-New Jersey channel, improvement of	i, 148, 8
Staten Island Sound (Arthur Kill), improvement of	i, 147, 8
Staten Island Sound (Arthur Kill), removal of wrecks	i, 158, 159, 955, 9
Staten Island water front, recommendation for stone monuments to mark established harbor lines	i, 1
Supervision of	i, 637; iii, 23
Tompkinsville, removal of wreck off	i, 145, 8
Totten, Fort, building for School of Submarine Defense	i, 13, 8
Niagara River, N. Y.:	
Buffalo Harbor, improvement of	i, 559; iii, 21
Erie Basin and Black Rock Harbor, improvement of Buffalo entrance	i, 562; iii, 21

Niagara River, N. Y.—Continued.

- Erie Basin and Black Rock Harbor, improvement of Lake Erie entrance 1, 562; III, 2142
- North Tonawanda to Lake Erie, including Tonawanda Harbor, improvement from 1, 563; III, 2144
- Surveys, etc. (*see* Northern and Northwestern Lakes) 1, 660; IV, 2671
- Nomini Creek, Va., improvement of 1, 209; II, 1057
- Nooksak River, Wash. (*see* Puget Sound) 1, 625; III, 2328
- Norfolk Harbor, Va.:
 - Harbor lines in Smith Creek and Elizabeth River 1, 640; II, 1089
 - Defenses of Hampton Roads 1, 14
 - Improvement of, and its approaches, including Hospital Point .. 1, 219; II, 1074
 - Improvement of waterway to Albemarle Sound, via Currituck Sound 1, 226; II, 1084
- Improvement of waterway to sounds of North Carolina, via Pasquotank River 1, 225; II, 1083
- Improvement of Western Branch, Elizabeth River 1, 220; II, 1076
- North Branch, Chicago River, Ill. *See* Chicago Harbor and River.
- North Brother Island, East River, N. Y., harbor lines 1, 640, 888
- North Carolina Cut, N. C., improvement of waterway via 1, 226; II, 1084
- North Carolina, State of:
 - Defenses of coast, including report on damp-proofing and on use of paint made of coal tar and kerosene oil 1, 9; IV, 2408
 - Improvement of waterways from Norfolk, Va., to sounds of 1, 225, 226; II, 1083, 1084
- North Coeymans, N. Y., removal of wreck in Hudson River 1, 139, 888
- Northeast River, N. C., improvement of 1, 238; II, 1105
- Northern and Northwestern Lakes:
 - Commercial statistics, Sault Ste. Marie canals, Mich. 1, 535; III, 2010, 2015
 - Dredge boat for harbors on Lake Erie. *See* Dredge boats, etc.
 - Dredge boat for harbors on eastern shore of Lake Michigan 1, 498, 979
 - Defenses of 1, 8, 9
 - Improvement of channels in waters connecting 1, 532; III, 2001
 - Outflow, rainfall, and evaporation in valley of 1, 665; IV, 2855
 - Survey of waters connecting lakes Superior and Huron, final report on .. 1, 542
 - Surveys and charts, with complete list of permanent and temporary bench marks 1, 660, 665; IV, 2671, 2693
 - Water levels 1, 665; IV, 2678
 - Water levels on east shore of Lake Michigan, variations in 1, 498
- Northern Pacific Railway Company:
 - Bridge of, across Deschutes River, Wash. 1, 645
 - Bridge of, across Humpulips River, Wash. 1, 651
 - Bridge of, across Lake Pend Oreille, Idaho 1, 646
 - Bridge of, across right of way of Lake Washington Canal, Wash. 1, 645
- North Fork, Kentucky River, Ky., bridge below Jackson 1, 645
- North Fork, Skagit River, Wash. (*see* Puget Sound) 1, 625; III, 2328
- North Hero Island channel, Lake Champlain, Vt., improvement of 1, 69
- North Landing River, Va. and N. C., improvement of waterway via .. 1, 226; II, 1084
- North Philippines, department of, reconnaissances and explorations, including technical features of engineer operations 1, 666, 669; IV, 2478, 2903
- North (Hudson) River, N. Y. *See* New York City and Harbor.
- North (Tolomato) River, Fla. (*see* St. Augustine Harbor) 1, 275; II, 1181
- North River, N. C.:
 - Improvement of waterway via 1, 226; II, 1084
 - Removal of wreck 1, 228; II, 1088
- North River, Wash. (*see* Willapa River) 1, 620; III, 2323
- North Tonawanda, N. Y. (*see* Tonawanda) 1, 563; III, 2144
- Norwalk Harbor, Conn., improvement of 1, 118, 849

O.

- Oak Creek, Wis. (*see* South Milwaukee Harbor) 1, 486; II, 1860
- Oakdene (steamer), removal of wreck 1, 194, 1024
- Oakland Harbor, Cal.:
 - Bridge across San Leandro Bay between Alameda and Bay Farm Island. 1, 646
 - Defenses of San Francisco, including report on construction methods, damp-proofing, and transportation of ordnance 1, 9; IV, 2417
 - Improvement of 1, 582; III, 2186

- Oak Orchard Harbor, N. Y., improvement of..... i, 565; iii, 2149
- Obion River, Tenn.:
 Bridge near Burnt Mills i, 646
 Improvement of i, 410; ii, 1579
- Occoquan Creek, Va., improvement of i, 205; ii, 1051
- Ocklawaha (Oklawaha) River, Fla., improvement of i, 275; ii, 1180
- Ocklockonee River, Fla.:
 Bridge in Leon County i, 649
 Bridge near Sopchoppy i, 652
- Ocmulgee River, Ga., improvement of i, 266; ii, 1161
- Oconee River, Ga., improvement of i, 265; ii, 1160
- Oconto Harbor, Wis., improvement of, including report on project by the
 Board of Engineers for Rivers and Harbors i, 476; ii, 1835, 1836
- Ocracoke Inlet, N. C., improvement of i, 229; ii, 1093
- Office of the Chief of Engineers, officers on duty in i, 676
- Officers, engineer, civilian assistants to i, 23
- Officers of the Corps of Engineers. *See* Corps of Engineers.
- Ogdensburg Harbor, N. Y., improvement of i, 573; iii, 2165
- Ohio River:
 Bridge between Allegheny and borough of McKees Rocks, Pa. i, 644
 Bridge between Ironton, Ohio, and Ashland, Ky. i, 644
 Bridge between Steubenville, Ohio, and Cross Creek Township, W. Va. i, 644
 Bridges impeding navigation, report upon i, 37
 Falls at Louisville, Ky., improvement of i, 452; ii, 1763
 Gauging (*see* Mississippi River Commission) i, 639; 8, 7, 8, 62, 97
 General improvement from Pittsburg to the mouth i, 423; ii, 1627
 Ice piers i, 423; ii, 1627
 Indiana Chute, Louisville, Ky., improvement of i, 452; ii, 1763
 Lock and Dam 1, at Davis Island, Pa., operating and care i, 435; ii, 1671
 Locks and Dams 2-7, construction of i, 435; ii, 1672
 Locks and Dams 8, 11, 13, 18, 19, construction of i, 441; ii, 1713
 Lock and Dam 37, construction of i, 426; ii, 1645
 Louisville and Portland Canal, Ky., enlargement of i, 452; ii, 1763
 Louisville and Portland Canal, Ky., operating and care i, 455; ii, 1765
 Pittsburg Harbor, Pa., improvement of i, 432; ii, 1667
 Pittsburg Harbor, Pa., Davis Island pool (No. 1), survey for increased
 depth and additional harbor facilities i, 434; ii, 1688
 Snag boat, operation of i, 426; ii, 1647
- Okanogan River, Wash., improvement of i, 635; iii, 2338
- Oklawaha River, Fla., improvement of i, 275; ii, 1180
- Olcott Harbor, N. Y., improvement of i, 566; iii, 2151
- Old Tampa Bay, Fla. (*see* Tampa Bay) i, 284; ii, 1198
- Olympia Harbor, Wash.:
 Bridge across Deschutes River i, 645
 Improvement of i, 626; iii, 2330
- Omaha Bridge and Terminal Railway Company, bridge of i, 642
- Omaha (East), Nebr., bridge across Missouri River to Council Bluffs, Iowa. i, 642
- Ontario Lake (*see also* Northern and Northwestern Lakes):
 Removal of wreck off Braddock Point light station i, 575; iii, 2169
 Water levels i, 665; iv, 2678
- Ontonagon Harbor, Mich., improvement of i, 470; ii, 1813
- Oostenaula River, Ga., improvement of i, 303, 305; ii, 1233
- Orange, Conn., Kimberly avenue bridge across West River to New Haven. i, 651
- Orange Mills flats, St. Johns River, Fla.:
 Improvement at and near i, 273; ii, 1178
 Removal of water hyacinths in vicinity of, including report on experi-
 ments made i, 279; ii, 1184; iv, 2433
- Orange River, Fla., improvement of i, 282; ii, 1194
- Ordnance. *See* Fortifications.
- Ordway rifle range i, 17, 686
- Osage River, Mo., improvement of i, 408; ii, 1568
- Oshkosh, Wis.:
 Bridge across Fox River i, 645
 Harbor lines in Fox River i, 640; ii, 1884
 Improvement of Fox River i, 489; ii, 1866
- Oswegatchie River, N. Y. (*see* Ogdensburg Harbor) i, 573; iii, 2165

Oswego Harbor, N. Y., improvement of	i, 570; III, 2160
Otter Creek, Vt., improvement of	i, 71, 750
Otter Tail Lake and River, Minn., survey of	i, 404; II, 1548
Ouachita River, Ark. and La.:	
Bridge between Ashley and Union counties, Ark	i, 643
Improvement of	i, 366; II, 1373
Outflow, rainfall, and evaporation in valley of Northern and Northwestern Lakes	i, 665; IV, 2855
Ozark and Cherokee Central Railway Company, bridge of	i, 642

P.

Pacific County, Wash., bridge of	i, 647
Pagan River, Va., improvement of	i, 222; II, 1079
Pamlico County, N. C., bridge of	i, 652
Pamlico River, N. C., improvement of	i, 231; II, 1094
Pamlico Sound, N. C., improvement of waterway to Norfolk, Va	i, 225; II, 1083
Pamunkey River, Va., improvement of	i, 215; II, 1064
Parks, public:	
District of Columbia, improvement and care	i, 658; IV, 2517
Mount Rainier National Park, Wash., survey for road	i, 37
Yellowstone National Park, improvement, etc., with report giving technical details	i, 668; IV, 2444, 2885
Pascagoula River, Miss.:	
Improvement above mouth of Dog River	i, 317; II, 1260
Improvement below mouth of Dog River	i, 315; II, 1258
Pasig River, Philippine Islands, improvement of	i, 670; IV, 2903, 2911
Pasquotank River, N. C.:	
Improvement of waterway via	i, 225; II, 1083
Removal of cribs of logs	i, 228; II, 1088
Passaic, N. J.:	
Improvement of Passaic River	i, 145, 927
Removal of wreck in Passaic River	i, 158, 954
Passaic Bridge, N. J., removal of wreck in Passaic River	i, 158, 954
Passaic light-house, Newark Bay, N. J., removal of wreck	i, 159, 955
Passaic River, N. J.:	
Improvement of	i, 145, 927
Removal of wrecks	i, 158, 159, 954, 955
Pass a Loutre, Mississippi River, La.:	
Closing crevasse in	i, 324; II, 1275
Constructing sill across	i, 325; II, 1276
Pass Manchac, La., bridge in St. John the Baptist Parish	i, 645
Patapasco River, Md.:	
Bridge at Spring Garden, Baltimore	i, 649
Defenses of Baltimore, including report on damp-proofing	i, 9; IV, 2400
Harbor lines at Sparrow Point	i, 640; II, 1033
Improvement of, and channel to Baltimore	i, 194; II, 1027
Improvement of channel to Curtis Bay	i, 196; II, 1031
Improvement of harbor at southwest Baltimore (Spring Garden)	i, 197; II, 1031
Revised estimate of cost of increasing depth of channel to Baltimore	i, 195; II, 1032
Patchogue River, N. Y., improvement of (<i>see</i> Great South Bay)	i, 134, 875
Patcong Creek, N. J., bridge at Steelmanville	i, 651
Patuxent River, Md., improvement of, including report on project by the Board of Engineers for Rivers and Harbors	i, 203; II, 1047, 1048
Pawcatuck River, R. I. and Conn., improvement of	i, 104, 831
Pawpaw River, Mich. (<i>see</i> St. Joseph Harbor)	i, 501; III, 1937
Pawtucket (Seekonk) River, R. I.:	
Harbor lines at Providence	i, 640, 825
Improvement of	i, 95, 799
Peace Creek, Fla. (<i>see</i> Charlotte Harbor)	i, 282; II, 1194
Pearl Harbor, Hawaii:	
Defenses of	i, 8, 9, 14, 17
Improvement of	i, 592; III, 2201
Pearl River, Miss.:	
Improvement between Edinburg and Jackson	i, 323; II, 1270
Improvement below Rockport	i, 322; II, 1269

- Pedee rivers, S. C.:
- Improvement of Little Pedee 1, 244; II
 - Improvement of Great Pedee 1, 245; II
- Pekskill Harbor, N. Y., improvement of 1, 15
- Pelham Bay Park, N. Y., bridge across East Chester Bay 1, 15
- Pell (sloop), removal of wreck of 1, 15
- Pender County, N. C., bridge of 1, 15
- Pend Oreille Lake, Idaho, bridge across 1, 15
- Pend Oreille River, Wash., improvement of 1, 635; III
- Pennsylvania Railroad Company:
- Bridge of 1, 64
 - Bridge of Philadelphia, Baltimore and Washington Railroad Company. 1, 64
- Penobscot River, Me.:
- Defenses of, including report on telephone booths and damp-proofing 1, 9; IV
 - Improvement of 1, 4
 - Improvement of Bucksport Harbor 1, 4
- Pensacola Harbor, Fla.:
- Defenses of, including report on damp-proofing 1, 9, 12; IV
 - Improvement of, including dredge construction 1, 299, 977; II
- Pentwater Harbor, Mich., improvement of 1, 512; III
- Pequonnock River, Conn. (*see* Bridgeport Harbor) 1, 11
- Pere Marquette Lake, Mich. (*see* Ludington Harbor) 1, 514; III
- Permanent International Commission of Congresses of Navigation 1, 589; III
- Petaluma Creek, Cal., improvement of 1, 224; II
- Petersburg, Va., diversion of Appomattox River at 1, 521; III
- Petoskey Harbor, Mich., improvement of 1, 521; III
- Philadelphia, Pa.:
- Bridge across Schuylkill River at Market street 1, 159, 95
 - Defenses of Delaware River 1, 16
 - Improvement of Delaware River at 1, 194
 - Removal of wreck in Delaware River at 1, 194
 - Removal of wreck in Schuylkill River at 1, 64
- Philadelphia, Baltimore and Washington Railroad Company, bridge of 1, 64
- Philadelphia, Bristol and Trenton Street Railway Company, bridge of 1, 64
- Philippine Islands:
- Defenses of 1, 670; IV, 2903, 2910
 - Improvement of Manila Harbor and Pasig River 1, 666, 669; IV, 2478
 - Reconnaissances and explorations in, with technical features of engineer operations in the former department of North Philippines, and present department of Luzon 1, 666, 669; IV, 2478
 - Service of officers of the Corps of Engineers abroad and in the field, with troops 1, 417; II
- Philippines (North), department of, reconnaissances and explorations, including technical features of engineer operations 1, 405; II
- Phillips, W. K. (steamer), removal of wreck of 1, 405; II
- Pierhead lines. *See* Harbor lines.
- Pierre, S. Dak. (*see* Missouri River) 1, 332; II
- Pierre, Fort, S. Dak. (*see* Missouri River) 1, 487; II
- Pigeon Bayous, La., improvement of 1, 282; II
- Pike Creek, Wis. (*see* Kenosha Harbor) 1, 519; III
- Pine Island Sound, Fla. (*see* Charlotte Harbor) 1, 530; III
- Pine Lake and River (Charlevoix County), Mich. (*see* Charlevoix Harbor) 1, 398; II
- Pine River (St. Clair County), Mich., improvement of 1, 399; II
- Pine River, Minn.:
- Construction of reservoir dam 1, 398; II
 - Operating and care of reservoir dam 1, 399; II
- Pineville, La.:
- Bridge across Red River to Alexandria (Alexandria and Pineville Bridge Company) 1, 583; III
 - Bridge across Red River to Alexandria (Shreveport and Red River Valley Railway Company) 1, 583; III
- Pinole, Point, Cal. (*see* San Pablo Bay) 1, 583; III
- Pittsburg Harbor, Pa.:
- See also* Allegheny, Monongahela, and Ohio rivers.
 - Bridge across Allegheny River, to Allegheny (Union Bridge) 1, 583; III

Pittsburg Harbor, Pa.—Continued.

- Bridge across Allegheny River at Brilliant Station i, 649
- Bridge across Allegheny River at Herr Island i, 649
- Harbor lines in Monongahela and Allegheny rivers... i, 640; ii, 1702, 1706, 1709
- Improvement of i, 432; ii, 1667
- Survey of Davis Island pool (No. 1), Ohio River, for increased depth
and additional harbor facilities i, 434; ii, 1688
- Plantz, Laura E. (canal boat), removal of wreck of i, 159, 955
- Plaquemine Bayou, La.:
 - Improvement of i, 332; ii, 1289
 - Removal of water hyacinths, including report on experiments made in
the Florida district i, 343; ii, 1312; iv, 2433
- Plattsburg Harbor, N. Y., improvement of i, 72, 751
- Plattsmouth Pontoon Bridge Company, bridge of i, 644
- Pleasant, Point, Me., bridge to Carlows Island i, 652
- Pleasantville and Atlantic Turnpike or Plank Road Company, bridge of... i, 647
- Plymouth Harbor, Mass., improvement of i, 86, 782
- Pocomoke River, Md., improvement of i, 189, 1015
- Poge, Cape, light-house, Mass., removal of wreck i, 103, 819
- Point Judith Harbor and Pond, R. I.:
 - Construction of harbor of refuge, with report on easterly detached
breakwater i, 99, 807, 809
 - Improvement of pond entrance i, 100, 814
- Point Pinole, Cal. (*see* San Pablo Bay) i, 583; iii, 2189
- Point Pleasant, Me., bridge to Carlows Island i, 652
- Point Wilson, Cal. (*see* San Pablo Bay) i, 583; iii, 2189
- Pokegama Falls, Mississippi River, Minn.:
 - Construction of reservoir dam i, 398; ii, 1528
 - Operating and care of reservoir dam i, 399; ii, 1538
- Pollock Rip light-ship, Mass., removal of wreck i, 103, 819
- Pomeroy, Ohio, ice harbor at Kerrs Run (*see* Ohio River) i, 423; ii, 1627
- Pomeroy Center, Ohio, ice pier (*see* Ohio River) i, 423; ii, 1627
- Ponchatoula River, La. (*see* Tickfaw River) i, 338; ii, 1303
- Pony Slough, Coos Bay, Oreg., improvement of i, 595; iii, 2209
- Popes Island, Va., removal of wreck i, 194, 1024
- Porcupine Island, Bar Harbor, Me., construction of breakwater i, 39, 714
- Portage Lake, Manistee County, Mich., improvement of harbor of re-
fuge i, 517; iii, 1973
- Portage Lake and Lake Superior canals, Houghton County, Mich.:
 - Improvement and care i, 471, 472; ii, 1815
 - Removal of wreck i, 475; ii, 1827
- Portage River, Houghton County, Mich., waterway via i, 471, 472; ii, 1815
- Portage River, Ohio (*see* Port Clinton Harbor) i, 543; iii, 2055
- Port Arthur Canal, Tex., connection with Sabine Lake i, 344; ii, 1314
- Port Chester Harbor, N. Y., improvement of i, 123, 858
- Port Clinton Harbor, Ohio, improvement of i, 543; iii, 2055
- Port Harford, Cal. (*see* San Luis Obispo Harbor) i, 578; iii, 2179
- Port Huron, Mich.:
 - Improvement of Black River at i, 529; iii, 1996
 - Removal of wreck in St. Clair River near iii, 2047
- Port Jefferson Harbor, N. Y., improvement of i, 127, 865
- Portland, Ky.:
 - Enlargement of Louisville and Portland Canal i, 452; ii, 1763
 - Operating and care of Louisville and Portland Canal i, 455; ii, 1765
- Portland, Me.:
 - Defenses of, including report on telephone booths and damp-proof-
ing i, 9; iv, 2371
 - Improvement of harbor i, 51, 725
- Porto Rico, defenses of i, 8, 9, 14, 17
- Port Reading, N. J., removal of wreck in Arthur Kill i, 159, 956
- Port Royal (Beaufort) River, S. C.:
 - Defenses of Port Royal Sound, including report on damp-proofing.. i, 9; iv, 2409
 - Improvement of i, 256; ii, 1139
 - Improvement of waterway between Beaufort and Charleston,
S. C. i, 255; ii, 1138
 - Improvement of waterway between Beaufort, S. C., and Savannah (*see*
Savannah Harbor) i, 257; ii, 1141
 - Removal of logs from waterway between Beaufort and Charleston,
S. C. i, 257; ii, 1140

- Port Royal Sound, S. C., defenses of, including report on damp-proofing..... i, 9; iv, 2409
- Portsmouth, N. H., defenses at, including report on damp-proofing..... i, 9; iv, 2374
- Portsmouth, Ohio, ice pier (*see* Ohio River)..... i, 423; ii, 1627
- Port Tampa, Fla. (*see* Tampa Bay)..... i, 284; ii, 1198
- Port Washington Harbor, Wis., improvement of..... i, 484; ii, 1855
- Portwing Harbor, Wis., improvement of..... i, 468; ii, 1809
- Position finders, range and..... i, 12, 15, 17
- Posts, military:
- Fort Leavenworth, Kans..... i, 5, 21, 23, 703
 - Fort Totten, N. Y., building for School of Submarine Defense..... i, 13, 16
 - Washington Barracks, D. C..... i, 17, 674, 675, 683; iv, 2934
- Potomac Park, Washington, D. C..... i, 658; iv, 2517
- Potomac River (*see also* Washington, D. C.):
- Aqueduct Bridge, Washington, D. C., repair of..... i, 652; iv, 2483
 - Defenses of Washington, D. C., including report on damp-proofing. i, 9; iv, 2405
 - Highway bridge at Washington, D. C., to replace Long Bridge. i, 643, 653; iv, 2484
 - Improvement at Washington, D. C..... i, 197; ii, 1035
 - Improvement below Washington, D. C..... i, 200; ii, 1038
 - Improvement of Eastern Branch (Anacostia River)..... i, 200; ii, 1040
 - Memorial Bridge, Washington, D. C..... i, 653; iv, 2484
 - Wreck near River View, Md..... i, 218; ii, 1071
- Potter, Sarah (schooner), removal of wreck of..... i, 103, 820
- Powow River, Mass., improvement of..... i, 61, 740
- Prairie du Chien, Wis., bridge across Wisconsin River..... i, 648
- Precipitation (rain), evaporation, and outflow in valley of Northern and Northwestern Lakes..... i, 665; iv, 2855
- Preliminary examinations of rivers and harbors. *See* Examinations.
- Presque Isle Harbor, Marquette, Mich., harbor of refuge..... i, 474; ii, 1823
- Presque Isle Peninsula, Erie, Pa., improvements at, use of land for water-supply purposes, status of title, etc..... i, 557; iii, 2115, 2117
- Printing Office, Government, Washington, D. C.:
- Construction of new building for..... i, 673; iv, 2919
 - Telegraph line..... i, 659; iv, 2517
- Projectors, searchlight..... i, 14, 15, 16, 17; iv, 2425
- Projects. *See* Fortifications and Rivers and harbors.
- Providence Harbor and River, R. I.:
- Harbor lines in Pawtucket (Seekonk) and Providence rivers..... i, 640, 825
 - Improvement of..... i, 95, 801
 - Improvement of Pawtucket River..... i, 95, 799
 - Removal of Green Jacket shoal..... i, 96, 803
- Provincetown Harbor, Mass., improvement of..... i, 87, 783
- Public buildings and grounds, District of Columbia..... i, 658; iv, 2517
- Public parks. *See* Parks.
- Puget Sound, Wash.:
- Bridge at Seattle, across Lake Washington Canal right of way..... i, 645
 - Defenses of..... i, 9
 - Improvement of, and tributaries..... i, 625; iii, 2328
 - Improvement of waterway to Lake Washington..... i, 629; iii, 2332
 - Reexamination of waterway to Lake Washington, with plans and estimates of cost..... i, 630; iii, 2340
- Puntalunos (vessel), removal of wreck of..... i, 271; ii, 1171
- Purification of water supply of Washington, D. C., with report concerning preliminary treatment of Potomac water..... i, 657; iv, 2505, 2511
- Puyallup River, Wash.:
- Bridge at Tacoma..... i, 648
 - Improvement of (*see* Puget Sound)..... i, 625; iii, 2328
 - Improvement of Tacoma Harbor..... i, 627; iii, 2331

Q.

- Queenstown Harbor, Md., improvement of..... i, 185, 1007
- Quinnipiac River, New Haven, Conn., improvement of..... i, 110, 839
- Quito (steamer), removal of wreck of..... i, 556; iii, 2104

R.

- Raccoon Creek, N. J., improvement of i, 173, 991
 Racine Harbor, Wis.:
 Improvement of i, 486; ii, 1861
 Reef in Lake Michigan near Wind Point i, 665; iv, 2883
 Railway, boat, Columbia River, Oreg. and Wash i, 604; iii, 2221
 Rainfall, evaporation, and outflow in valley of Northern and Northwestern
 Lakes i, 665; iv, 2855
 Rainier, Mount, National Park, Wash., survey for road i, 37
 Raisin River, Mich. (*see* Monroe Harbor) i, 528; iii, 1995
 Ram Island light-house, Boothbay Harbor, Me., removal of wreck i, 53, 727
 Rancocas River, N. J.:
 Bridge at Hainesport i, 647
 Improvement of i, 166, 984
 Removal of wreck i, 194, 1023
 Range and position finders i, 12, 15, 17
 Ranges, rifle i, 17, 686
 Rappahannock River, Va., improvement of i, 210; ii, 1058
 Raritan Bay and River, N. J.:
 Improvement of bay i, 150, 937
 Improvement of Keyport Harbor i, 151, 939
 Improvement of river i, 152, 943
 Improvement of Shoal Harbor i, 154, 948
 Removal of wreck at Metuchen i, 159, 955
 Reconnaissances and explorations, military, with report on technical fea-
 tures of engineer operations in the former department of North Philip-
 pines, and present department of Luzon i, 667; iv, 2478, 2903
 Red Hook channel, New York Harbor, N. Y., improvement of i, 142, 915
 Red Lake, Minn.:
 Improvement of (*see* Red River of the North) i, 401; ii, 1543
 Survey of i, 403; ii, 1548
 Red Lake River, Minn.:
 Improvement of (*see* Red River of the North) i, 401; ii, 1543
 Survey of i, 403; ii, 1548
 Red River, La., Ark., Tex., and Ind. T.:
 Bridge between Alexandria and Pineville, La. (Alexandria and Pine-
 ville Bridge Company) i, 644
 Bridge between Alexandria and Pineville, La. (Shreveport and Red
 River Valley Railway Company) i, 643
 Bridge near Shreveport, La. i, 643
 Gauging (*see* Mississippi River Commission) i, 639; S., 7, 8, 62, 97
 Improvement of i, 361; ii, 1363
 Rectification of mouth by Mississippi River Commission i, 639; S., 3, 40
 Red River of the North, Minn. and N. Dak.:
 Improvement of i, 401; ii, 1543
 Survey of Otter Tail Lake and River for reservoir dam i, 404; ii, 1548
 Survey of Red Lake and Red Lake River for reservoir dam i, 403; ii, 1548
 Redwood Creek, Cal., improvement of i, 581; iii, 2182
 Reflectors, searchlight i, 14, 15, 16, 17; iv, 2425
 Regulations and rules:
 For navigation of canals, etc. i, 641
 For opening of drawbridges i, 642
 Rehoboth Bay, Del., waterway via i, 180, 1002
 Reservations, public. *See* Parks.
 Reservoirs:
 Big Stone Lake, Minn., survey of i, 404; ii, 1549
 Mississippi River, headwaters, construction of i, 398; ii, 1528
 Mississippi River, headwaters, operating and care i, 399; ii, 1538
 Mississippi River, headwaters, survey of flowage lines i, 398; ii, 1532
 Otter Tail Lake and River, Minn., survey of i, 404; ii, 1548
 Red Lake and Red Lake River, Minn., survey of i, 403; ii, 1548
 Traverse Lake, Minn., survey of i, 404; ii, 1549
 Washington Aqueduct, D. C. i, 654, 655; iv, 2485, 2499
 Revere, Mass., bridge across Saugus River to Lynn i, 650
 Rice Irrigation and Improvement Association of Louisiana, lock and dam
 in Mermentau River i, 641
 Richland Creek, Tenn. (*see* Tennessee River above Chattanooga) i, 417; ii, 1592

Richmond Harbor, Va. (<i>see</i> James River)	i, 216; ii, 10
Rifle ranges	i, 17, 6
Ringleader (barge), removal of wreck of	i, 145, 9
Ripley, Ohio, ice pier (<i>see</i> Ohio River)	i, 423; ii, 16
Rivers and harbors (<i>see also</i> Technical details):	
Appropriations for operations during the past year	i,
Appropriations for 1904-5, estimates of	i, 36, 6
Board of Engineers for (<i>see also</i> Committee, etc.)	i, 36, 6
Board of Engineers, The	i, 8, 6
Bridges	i, 642, 650, 6
Committee on, House of Representatives. <i>See</i> Committee, etc.	
Engineer divisions	i,
Examinations and surveys required to be made by act of 1902	i,
Expenditures during the past year	i,
Harbor lines, establishment of	i, 6
Rules governing navigation of canals, etc.	i, 6
Rules governing the opening of drawbridges	i, 6
Status of works	i,
River View, Potomac River, Md., removal of wreck	i, 218; ii, 10
Roads:	
Fort Washakie, Wyo., to Buffalo Fork, Snake River	i, 675; iv, 29
In military divisions and departments	i, 667; iv, 2478, 28
In Mount Rainier National Park, Wash.	i,
In Yellowstone National Park, with technical details concerning construction, etc.	i, 666; iv, 2444, 28
Roanoke River, N. C., improvement of	i, 227; ii, 10
Rochambeau statue, Washington, D. C.	i, 658; iv, 25
Rockhall Harbor, Md., improvement of	i, 184, 10
Rockhaven, N. Dak., ice harbor (<i>see</i> Missouri River)	i, 406; ii, 15
Rockland Harbor, Me.:	
Harbor lines in Lermonds Cove	i, 640, 7
Improvement of	i, 47, 7
Rockport, Mass.:	
Construction of harbor of refuge in Sandy Bay, with report relative to completion of project	i, 62, 740, 7
Improvement of harbor	i, 64, 7
Rock River, Ill.:	
Construction of canal around	i, 496; iii, 19
Operating and care of canal around	i, 395; ii, 14
Romerly Marsh, Ga., improvement of waterway via	i, 269; ii, 11
Rondout Harbor, N. Y., improvement of	i, 137, 8
Root River, Wis. (<i>see</i> Racine Harbor)	i, 486; ii, 18
Rouge River, Mich., improvement of	i, 528; iii, 19
Rough River, Ky.:	
Improvement of	i, 463; ii, 17
Operating and care of lock and dam	i, 464; ii, 17
Rules and regulations:	
For navigation of canals, etc.	i, 6
For opening of drawbridges	i, 6

S.

Sabine Lake, Pass, and River, Tex.:	
Connection with Port Arthur Canal	i, 344; ii, 13
Improvement of mouth of river and of channel through lake	i, 344; ii, 13
Improvement of river	i, 345; ii, 13
Improvement of Sabine Pass Harbor	i, 346; ii, 13
Saco River, Me., improvement of	i, 54, 7
Sacramento County, Cal., bridge of	i, 6
Sacramento River, Cal.:	
Bridge of J. E. Terry across	i, 6
Improvement of	i, 587; iii, 21
Improvement of, by California Debris Commission	i, 638; iii, 23
Sag Harbor, N. Y., improvement at	i, 130, 8
Saginaw River, Mich., improvement of	i, 524; iii, 19
St. Augustine Creek, Ga., bridge across	i, 6
St. Augustine Harbor, Fla., improvement of	i, 275; ii, 11

- St. Clair Canal and River, Mich.:
 Improvement of i, 539; iii, 2033
 Improvement of channels in waters connecting the Great Lakes. i, 532; iii, 2001
 Operating and care of canal i, 540; iii, 2034
 Removal of wrecks i, 542; iii, 2046, 2047
 Surveys, etc. (*see* Northern and Northwestern Lakes) i, 660; iv, 2671
- St. Croix Lake and River, Wis. and Minn., improvement of i, 400; ii, 1540
- St. Francis, Ark., bridge across St. Francis River i, 644
- St. Francis River, Ark. and Mo.:
 Bridge in Lee County, Ark. i, 644
 Bridge at St. Francis, Ark. i, 644
 Gauging (*see* Mississippi River Commission) i, 639; S., 7, 8, 62, 97
 Improvement of, in Arkansas i, 386; ii, 1436
 Improvement of, in Missouri i, 388; ii, 1438
- St. George Sound, Fla. (*see* Carrabelle bar and harbor) i, 290; ii, 1207
- St. Johns River, Fla.:
 Defenses of, including report on damp-proofing i, 9; iv, 2413
 Harbor lines at Jacksonville i, 640; ii, 1187
 Improvement between Jacksonville and the ocean, including dredge construction i, 271, 976; ii, 1173
 Improvement between Jacksonville and Palatka, including Orange Mills flats i, 273; ii, 1178
 Improvement of Volusia bar, and between Volusia bar and Lake Monroe i, 274; ii, 1179
 Removal of water hyacinths, including report on experiments made i, 279; ii, 1184; iv, 2433
- St. Jones River, Del. (*see* Murderkill River) i, 177, 996
- St. Joseph Harbor and River, Mich.:
 Improvement of harbor i, 501; iii, 1937
 Improvement of river i, 501, 502; iii, 1938
- St. Lawrence River, N. Y.:
 Cape Vincent Harbor, improvement of i, 572; iii, 2162
 Defenses of i, 8, 9
 Long Sault Island, improvement at head of i, 574; iii, 2168
 Ogdensburg Harbor, improvement of i, 573; iii, 2165
 Ogdensburg to foot of Lake Ontario, removal of shoals i, 573; iii, 2165
- St. Lawrence River Power Company i, 574; iii, 2168
- St. Louis, Mo.:
 Harbor lines in Mississippi River i, 640; ii, 1455
 Improvement of Mississippi River between mouths of Missouri and Ohio rivers i, 390; ii, 1445
 Survey for waterway to Lockport, Ill. i, 494, 639; iii, 1904; S., 7, 68, 167
- St. Louis Bay and River, Minn. and Wis. (*see* Duluth Harbor) i, 466; ii, 1794
- St. Mary Park Association, bridge of i, 650
- St. Marys River and St. Marys Falls Canal, Mich.:
 Commercial statistics i, 535; iii, 2010, 2015
 Improvement of channels in waters connecting the Great Lakes. i, 532; iii, 2001
 Improvement of Hay Lake and Neebish channels i, 537; iii, 2027
 Improvement of river at the falls i, 534; iii, 2006
 Operating and care of canal i, 535; iii, 2010
 Surveys, etc. (*see* Northern and Northwestern Lakes) i, 660; iv, 2671
 Survey for improvement, final report on i, 542
 Water-power canal at Sault Ste. Marie i, 641
- St. Paul, Minn.:
See also Mississippi River.
 Gauging Mississippi River at i, 405; ii, 1549
 Harbor lines in Mississippi River at i, 640; ii, 1513
- St. Peters River, Minn. *See* Minnesota River.
- St. Thomas (schooner), removal of wreck of i, 103, 819
- Sakonnet River, R. I., improvement of i, 94, 798
- Salmon Bay, Wash.:
 Improvement of waterway via i, 629; iii, 2332
 Reexamination of waterway via, with plans and estimates of cost. i, 630; iii, 2340
- Salmon River, Conn. (*see* Connecticut River) i, 107, 836
- Samamish Lake, Wash. *See* Puget Sound-Lake Washington waterway.
- Sampit River (Georgetown Harbor), S. C. (*see* Winyah Bay) i, 246; ii, 1122
- San Antonio estuary, Cal. (*see* Oakland Harbor) i, 582; iii, 2186

- Sandbeach, Mich.:
 Improvement of harbor of refuge i, 526; iii, 1989
 Water levels i, 665; iv, 2678
- San Diego Harbor, Cal.:
 Defenses of i, 9
 Improvement of i, 575; iii, 2171
- Sandusky Harbor, Ohio, improvement of, including dredge construction i, 545, 979; iii, 2057
- Sandwich Islands. *See* Hawaiian Islands.
- Sandy Bay, Cape Ann, Mass.:
 Construction of harbor of refuge, with report relative to completion of project i, 62, 740, 742
 Improvement of Rockport Harbor i, 64, 743
- Sandy Lake, Minn.:
 Construction of reservoir dam i, 398; ii, 1528
 Operating and care of reservoir dam i, 399; ii, 1538
- San Francisco Bay and Harbor, Cal.:
 Defenses of, including report on construction methods, damp-proofing, and transportation of ordnance i, 9; iv, 2417
 Harbor lines north of China Basin and Mission rock i, 640; iii, 2202
 Improvement of channel between Straits of Karquines and the Golden Gate i, 583; iii, 2189
 Improvement of harbor i, 582; iii, 2184
 Improvement of Oakland Harbor i, 582; iii, 2186
- Sanitary District of Chicago, Ill., connection of Chicago River with drainage canal i, 640
- San Jacinto River, Tex.:
 Bridge across i, 648
 Improvement of (*see* Galveston ship channel) i, 351; ii, 1334
- San Joaquin County, Cal., bridge of i, 646
- San Joaquin River, Cal.:
 Bridge across Mormon channel at Stockton i, 648
 Improvement of i, 584; iii, 2190
 Improvement of, by California Débris Commission i, 638; iii, 2368
 Improvement of Stockton and Mormon channels i, 584, 585; iii, 2190, 2193
- San Juan, P. R., defenses of i, 8, 9, 14, 17
- Sankaty Head, Nantucket Island, Mass., removal of wrecks near Bass Rip i, 104, 820
- San Leandro Bay, Cal.:
 Bridge between Alameda and Bay Farm Island i, 646
 Improvement of (*see* Oakland Harbor) i, 582; iii, 2186
- San Luis d'Apra, Guam, defenses of i, 8, 9, 14, 17
- San Luis Obispo Harbor, Cal., improvement of i, 578; iii, 2179
- San Pablo Bay, Cal., improvement of i, 583; iii, 2189
- San Pedro Bay and Harbor, Cal.:
 Construction of deep-water harbor i, 576; iii, 2173
 Improvement of Wilmington inner harbor i, 577; iii, 2175
- Santee River, S. C., improvement of i, 248; ii, 1127
- Sarasota Bay, Fla., improvement of i, 284; ii, 1197
- Saugatuck Harbor, Mich., improvement of i, 504; iii, 1945
- Saugatuck River, Conn., improvement of i, 118, 849
- Saugerties Harbor, N. Y., improvement of i, 130, 883
- Saugus River, Mass.:
 Bridge between Revere and Lynn i, 650
 Improvement of Lynn Harbor i, 73, 759
- Sauk River, Wis. (*see* Port Washington Harbor) i, 481; ii, 1855
- Sault Ste. Marie, Mich. *See* St. Marys River.
- Sausal Creek, Cal. (*see* Oakland Harbor) i, 582; iii, 2186
- Savannah and Tybee Railroad, bridge across St. Augustine Creek, Ga. i, 652
- Savannah Harbor and River, Ga.:
 Defenses of i, 9
 Improvement of harbor, including dredge construction i, 257, 980; ii, 1141
 Improvement of river above Augusta i, 261; ii, 1155
 Improvement of river between Augusta and Savannah i, 260; ii, 1152
 Improvement of waterway to Beaufort, S. C. (*see* Savannah Harbor) i, 257; ii, 1141
 Improvement of waterway to Fernandina, Fla. i, 269; ii, 1166
 Removal of wreck in harbor i, 271; ii, 1171

- Sawyer, Emily G. (schooner), removal of wreck of i, 103, 820
 Sayville, N. Y., improvement of Browns Creek i, 133, 874
 Schools:
 Engineer School of Application i, 19, 674, 675, 689; iv, 2934
 School of Submarine Defense, building for i, 13, 16
 Schuylkill River, Pa.:
 Bridge at Market street, Philadelphia i, 648
 Removal of wreck i, 194, 1024
 Scituate Harbor, Mass., improvement of, including report on project by the
 Board of Engineers for Rivers and Harbors i, 84, 777
 Scuppernon River, N. C., improvement of i, 229; ii, 1091
 Seacoast defenses. *See* Fortifications.
 Searchlights, including notes on projectors i, 14, 15, 16, 17; iv, 2425
 Seattle, Wash.:
 Bridge across right of way of Puget Sound-Lake Washington waterway i, 645
 Improvement of Puget Sound-Lake Washington waterway i, 629; iii, 2332
 Reexamination of Puget Sound-Lake Washington waterway, with plans
 and estimates of cost i, 630; iii, 2340
 Seattle and Montana Railroad Company, bridges of i, 645, 647
 Seattle and Renton Railway Company, bridge of i, 645
 Sea walls i, 13, 16, 17
 Sebawaing River, Mich., improvement of i, 525; iii, 1987
 Secretary Creek (Warwick River), Md., improvement of i, 188, 1014
 Seekonk (Pawtucket) River, R. I.:
 Harbor lines at Providence i, 640, 825
 Improvement of i, 95, 799
 Service of officers of Corps of Engineers abroad and in the field, with troops i, 24
 Shag rocks, San Francisco Harbor, Cal., removal of i, 582; iii, 2184
 Shaws Cove, New London, Conn. *See* New London and Thames River.
 Sheboygan Harbor, Wis., improvement of i, 483; ii, 1853
 Sheridan statue, Washington, D. C. i, 658; iv, 2517
 Sherman statue, Washington, D. C. i, 658; iv, 2517
 Sherman, Will (barge), removal of wreck of i, 158, 955
 Shiawassee River, Mich., improvement of i, 525; iii, 1986
 Shilshole Bay, Wash.:
 Improvement of waterway via i, 629; iii, 2332
 Reexamination of waterway via, with plans and estimates of
 cost i, 630; iii, 2340
 Ship channel connecting waters of the Great Lakes, improvement of i, 532; iii, 2001
 Ship Island Harbor, Miss., improvement of channel to Gulfport i, 320; ii, 1266
 Ship John light-house, Delaware Bay, removal of wrecks i, 165, 971, 972
 Shipyard Landing, Pasquotank River, N. C., removal of cribs of logs i, 228; ii, 1088
 Shoal Harbor, N. J., improvement of i, 154, 948
 Shoalwater Bay (Willapa Harbor), Wash., improvement of i, 620; iii, 2323
 Shovelful Shoal, Mass., removal of wreck i, 103, 819, 820
 Shreveport, La.:
 Bridge across Red River near i, 643
 Improvement of Red River at i, 361; ii, 1363
 Waterway to Jefferson, Tex. (*see* Cypress Bayou) i, 365; ii, 1372
 Shreveport and Red River Valley Railway Company:
 Bridge of, across Bayou des Glaisses, La i, 648
 Bridge of, across Red River, La i, 643
 Shreveport Bridge and Terminal Company, bridge of i, 643
 Shrewsbury River, N. J., improvement of i, 155, 950
 Simmons Ferry, Little River, La., bridge near i, 650
 Sinepuxent Bay, Md., waterway via i, 180, 1002
 Sioux City, Iowa. *See* Missouri River.
 Sioux River, S. Dak., ice harbor at Sioux City, Iowa i, 406; ii, 1551
 Sites for fortifications i, 13, 14, 15, 17
 Siuslaw River, Oreg.:
 Examination and survey at mouth and at and near Florence i, 599; iii, 2229
 Improvement at mouth i, 598; iii, 2213
 Six-mile Island, Allegheny River, Pa., construction of lock and dam i, 438; ii, 1680
 Skagit River, Wash. (*see* Puget Sound) i, 625; iii, 2328
 Skykomish River, Wash. (*see* Puget Sound) i, 625; iii, 2328
 Slack-water systems. *See* Canals and Waterways.
 Smith Creek, Norfolk Harbor, Va., harbor lines i, 640; ii, 1089

- Sandbeach, Mich.:**
 Improvement of harbor of refuge i, 526; iii, 1969
 Water levels i, 665; iv, 2678
- San Diego Harbor, Cal.:**
 Defenses of i, 9
 Improvement of i, 575; iii, 2171
- Sandusky Harbor, Ohio, improvement of, including dredge construction** i, 545, 979; iii, 2057
- Sandwich Islands. See Hawaiian Islands.**
- Sandy Bay, Cape Ann, Mass.:**
 Construction of harbor of refuge, with report relative to completion of project i, 62, 740, 742
 Improvement of Rockport Harbor i, 64, 743
- Sandy Lake, Minn.:**
 Construction of reservoir dam i, 398; ii, 1528
 Operating and care of reservoir dam i, 399; ii, 1538
- San Francisco Bay and Harbor, Cal.:**
 Defenses of, including report on construction methods, damp-proofing, and transportation of ordnance i, 9; iv, 2417
 Harbor lines north of China Basin and Mission rock i, 640; iii, 2202
 Improvement of channel between Straits of Karquines and the Golden Gate i, 583; iii, 2189
 Improvement of harbor i, 582; iii, 2184
 Improvement of Oakland Harbor i, 582; iii, 2186
- Sanitary District of Chicago, Ill., connection of Chicago River with drainage canal** i, 640
- San Jacinto River, Tex.:**
 Bridge across i, 648
 Improvement of (*see* Galveston ship channel) i, 351; ii, 1334
- San Joaquin County, Cal., bridge of** i, 646
- San Joaquin River, Cal.:**
 Bridge across Mormon channel at Stockton i, 648
 Improvement of i, 584; iii, 2190
 Improvement of, by California Débris Commission i, 638; iii, 2368
 Improvement of Stockton and Mormon channels i, 584, 585; iii, 2190, 2193
- San Juan, P. R., defenses of** i, 8, 9, 14, 17
- Sankaty Head, Nantucket Island, Mass., removal of wrecks near Bass Rip** i, 104, 820
- San Leandro Bay, Cal.:**
 Bridge between Alameda and Bay Farm Island i, 646
 Improvement of (*see* Oakland Harbor) i, 582; iii, 2186
- San Luis d'Apra, Guam, defenses of** i, 8, 9, 14, 17
- San Luis Obispo Harbor, Cal., improvement of** i, 578; iii, 2179
- San Pablo Bay, Cal., improvement of** i, 583; iii, 2189
- San Pedro Bay and Harbor, Cal.:**
 Construction of deep-water harbor i, 576; iii, 2173
 Improvement of Wilmington inner harbor i, 577; iii, 2175
- Santee River, S. C., improvement of** i, 248; ii, 1127
- Sarasota Bay, Fla., improvement of** i, 284; ii, 1197
- Saugatuck Harbor, Mich., improvement of** i, 504; iii, 1945
- Saugatuck River, Conn., improvement of** i, 118, 849
- Saugerties Harbor, N. Y., improvement of** i, 136, 883
- Saugus River, Mass.:**
 Bridge between Revere and Lynn i, 650
 Improvement of Lynn Harbor i, 73, 759
- Sauk River, Wis. (*see* Port Washington Harbor)** i, 481; ii, 1855
- Sault Ste. Marie, Mich. See St. Marys River.**
- Sausal Creek, Cal. (*see* Oakland Harbor)** i, 582; iii, 2186
- Savannah and Tybee Railroad, bridge across St. Augustine Creek, Ga.** i, 652
- Savannah Harbor and River, Ga.:**
 Defenses of i, 9
 Improvement of harbor, including dredge construction i, 257, 980; ii, 1141
 Improvement of river above Augusta i, 261; ii, 1155
 Improvement of river between Augusta and Savannah i, 260; ii, 1152
 Improvement of waterway to Beaufort, S. C. (*see* Savannah Harbor) i, 257; ii, 1141
 Improvement of waterway to Fernandina, Fla i, 269; ii, 1166
 Removal of wreck in harbor i, 271; ii, 1171

- Stage Harbor, Mass. (*see* Chatham Harbor) i, 88, 785
- Stamford Harbor, Conn., improvement of i, 120, 850
- Starve Island reef, Lake Erie, removal of wreck i, 556; iii, 2105
- Staten Island, N. Y., recommendation for stone monuments to mark established harbor lines i, 141
- Staten Island Sound (Arthur Kill), N. Y. and N. J.:
See also Staten Island.
 Improvement of i, 147, 932
 Removal of wrecks i, 158, 159, 955, 956
- Statistics of commerce, Sault Ste. Marie canals, Mich. i, 535; iii, 2010, 2015
- Statues, memorials, etc.:
 In public grounds, Washington, D. C i, 658; iv, 2517
 Memorial Bridge, Washington, D. C i, 653; iv, 2484
 Monuments to Gens. Francis Nash and William Lee Davidson .. i, 676; iv, 2939
- Steamboats:
See also Dredge and Snag boats, and Wrecks.
 Rules governing running of, on certain streams i, 641
- Steelmanville, N. J., bridge across Patcong Creek i, 651
- Steubenville, Ohio, bridge across Ohio River to Cross Creek Township, W. Va. i, 644
- Steubenville Bridge Company, bridge of i, 644
- Stillaguamish River, Wash. (*see* Puget Sound) i, 625; iii, 2328
- Still Bluff, N. C., bridge across Black River i, 648
- Stillwater Harbor, Minn. (*see* St. Croix River) i, 400; ii, 1540
- Stockbridge Landing, Lake Winnebago, Wis. (*see* Fox River) i, 489; ii, 1866
- Stockton, Cal.:
See also San Joaquin River.
 Bridge across Mormon channel i, 648
- Stockton channel, San Joaquin River, Cal., improvement of. i, 584, 585; iii, 2190, 2193
- Stone Bridge, Sakonnet River, R. I., alteration of i, 94, 798
- Studhams, Milton R. (schooner), removal of wreck of i, 165, 971
- Sturgeon Bay and Lake Michigan Canal, Wis.:
 Improvement of, including harbor of refuge i, 478; ii, 1841
 Operating and care i, 480; ii, 1846
- Subic Bay, Philippine Islands, defenses of i, 8, 9, 14, 17
- Submarine defense, including building for school of, etc. i, 13, 15, 16, 17
- Sullivan Falls Harbor, Me., improvement of i, 40, 714
- Sullivan Island shore, Charleston, S. C., improvement at i, 253; ii, 1134
- Sullivan River, Me., improvement of Sullivan Falls Harbor i, 40, 714
- Sulphur River, Ark. and Tex. (*see* Red River) i, 361; ii, 1363
- Sunken craft. *See* Wrecks.
- Superior Bay and Harbor, Wis.:
 Improvement of i, 466; ii, 1794
 Removal of wreck in Lake Superior ii, 1828
- Superior Lake (*see also* Northern and Northwestern Lakes):
 Commercial statistics, Sault Ste. Marie canals, Mich. i, 535; iii, 2010, 2015
 Final report on survey of waterway to Lake Huron i, 542
 Harbor lines at Duluth, Minn i, 640; ii, 1828
 Improvement and care of waterway to Keweenaw Bay i, 471, 472; ii, 1815
 Removal of wreck in waterway to Keweenaw Bay i, 475; ii, 1827
 Removal of wrecks near Duluth ii, 1828
 Water levels i, 665; iv, 2678
 Water-power canal at Sault Ste. Marie, Mich. i, 641
- Supervision of New York Harbor, N. Y i, 637; iii, 2359
- Surface levels. *See* Gauging.
- Surveys:
 In military divisions and departments, with report on technical features
 of engineer operations in the former department of North Philippines,
 and present department of Luzon i, 667; iv, 2478, 2903
 Northern and Northwestern Lakes i, 660; iv, 2671
 Of rivers and harbors, estimate of appropriation for i, 636
 Of rivers and harbors required to be made by act of 1902 i, 36
- Susquehanna River, Md., improvement of i, 183, 1004
- Sutton (steamer), removal of wreck of i, 194, 1024
- Suwanee River, Fla., improvement of i, 288; ii, 1202
- Swinomish Slough, Wash., improvement of i, 632; iii, 2336
- Synepuxent Bay, Md., waterway via i, 180, 1002
- Syracuse, Ohio, ice pier (*see* Ohio River) i, 423; ii, 1627

T.

- Tacoma Harbor, Wash.:
 Bridge across Puyallup River..... 1, 6
 Improvement of..... 1, 627; III, 23
- Tallahatchie River, Miss., improvement of..... 1, 373; II, 13
- Tampa Bay and Harbor, Fla.:
 Defenses of, including report on damp-proofing..... 1, 9; IV, 24
 Improvement of bay..... 1, 284; II, 11
 Improvement of Hillsboro Bay and River..... 1, 285; II, 12
- Tangier Sound, Md., removal of wrecks in Deal Island Harbor..... 1, 194, 10
- Tanks, cable..... 1, 13, 15
- Target firing..... 1, 17, 6
- Tar River, N. C., improvement of..... 1, 231; II, 10
- Taunton River, Mass.:
 Improvement of..... 1, 93, 7
 Improvement of Fall River Harbor..... 1, 97, 8
- Tchefuncte River, La., improvement of..... 1, 337; II, 13
- Tchula Lake, Miss., improvement of..... 1, 373; II, 13
- Teche Bayou, La.:
 Bridge at Franklin..... 1, 6
 Improvement of..... 1, 334; II, 12
 Removal of water hyacinths, including report on experiments made in the Florida district..... 1, 343; II, 1312; IV, 24
- Technical details of engineering methods..... IV, 23
- Baltimore, Md., defenses of, damp-proofing..... IV, 24
- Boston, Mass., defenses of, damp-proofing..... IV, 23
- Columbia River, defenses of mouth, construction methods and speaking tubes..... IV, 24
- Florida, defenses of coast, damp-proofing..... IV, 24
- Galveston, Tex., defenses of, damp-proofing..... IV, 24
- Key West, Fla., defenses of, damp-proofing..... IV, 24
- Long Island Sound, defenses of eastern entrance, damp-proofing..... IV, 23
- Maine, defenses of coast, telephone booths and damp-proofing..... IV, 23
- Missouri River, dike and revetment construction..... IV, 24
- Mobile, Ala., defenses of, damp-proofing..... IV, 24
- Narragansett Bay, R. I., defenses of, foundations, damp-proofing, and painting of concrete..... IV, 23
- New Orleans, La., defenses of, damp-proofing..... IV, 24
- New York, N. Y., defenses of, damp-proofing..... IV, 23
- North Carolina, defenses of coast, damp-proofing, and use of paint made of coal tar and kerosene oil..... IV, 24
- Philippine Islands, engineer operations in the former department of North Philippines, and present department of Luzon..... IV, 24
- Portsmouth, N. H., defenses of, damp-proofing..... IV, 23
- San Francisco, Cal., defenses of, construction methods, damp-proofing, and transportation of ordnance..... IV, 24
- Searchlight projectors, notes on..... IV, 24
- South Carolina, defenses of coast, damp-proofing..... IV, 24
- Tampa, Fla., defenses of, damp-proofing..... IV, 24
- Washington, D. C., defenses of, damp-proofing..... IV, 24
- Water hyacinths, report on experiments for destruction of, in Florida waters..... IV, 24
- Yellowstone National Park, roads, bridges, etc..... IV, 24
- Telegraph line, Government, Washington, D. C..... 1, 659; IV, 25
- Tennessee Central Railroad Company, bridge of..... 1, 6
- Tennessee River:
 Chattanooga, Tenn., improvement above..... 1, 417; II, 1591, 15
 Chattanooga, Tenn., to Riverton, Ala., improvement from..... 1, 418; II, 1591, 15
 Gauging (*see* Mississippi River Commission)..... 1, 639; S., 7, 8, 62
 Muscle Shoals Canal, Ala., operating and care..... 1, 419; II, 1591, 15
 Riverton, Ala., improvement below..... 1, 419; II, 1591, 15
- Tensas River, La., improvement of..... 1, 368, 370; II, 13
- Terraceia Cut-off, Fla. (*see* Manatee River)..... 1, 287; II, 12
- Terry, J. E., bridge of..... 1, 6
- Texas:
 Dredge and snag boat for certain works in..... 1, 354; II, 13
 Removal of water hyacinths from waters in..... 1, 3
 Texas City, Tex., improvement of channel to Galveston..... 1, 351; II, 13

Thames River, Conn.:

Bridge across Smiths Cove near New London..... i, 652

Improvement of..... i, 106, 834

Improvement of New London Harbor..... i, 105, 833

Thatcher, Addie (schooner), removal of wreck of..... i, 194, 1024

The Board of Engineers..... i, 8, 679

Three Brothers (sloop), removal of wreck of..... i, 194, 1024

Three-mile Rapids, Columbia River, Oreg. and Wash., improvement at..... i, 604; iii, 2221

Thunder Bay River, Mich., improvement of Alpena Harbor..... i, 523; iii, 1985

Tickfaw River, La., improvement of, including tributaries..... i, 338; ii, 1303

Tillamook Bay and bar, Oreg.:

Improvement of..... i, 601; iii, 2216

Survey of ocean bar..... i, 602; iii, 2239

Tiverton, R. I., improvement of Sakonnet River at..... i, 94, 798

Toledo Harbor, Ohio:

Harbor lines in Maumee River..... i, 640; iii, 2107

Improvement of, including dredge construction..... i, 542, 979; iii, 2049

Removal of wreck in Maumee Bay..... i, 557; iii, 2106

Toledo (steamer), removal of wreck of..... i, 475; ii, 1827

Tolomato River, Fla. (see St. Augustine Harbor)..... i, 275; ii, 1181

Tombigbee River, Ala. and Miss.:

Columbus to Walkers Bridge, Miss., improvement from..... i, 313; ii, 1250

Demopolis, Ala., improvement below..... i, 310, 311; ii, 1246, 1248

Demopolis, Ala., to Columbus, Miss., improvement from..... i, 312; ii, 1249

Tompkinsville, N. Y., removal of wreck off..... i, 145, 924

Tonawanda Harbor, N. Y., improvement of..... i, 563; iii, 2144

Tongue Point, Columbia River, Oreg., improvement below..... i, 614; iii, 2270

Tonnage, Sault Ste. Marie canals, Mich..... i, 535; iii, 2010, 2015

Torpedoes..... i, 13, 15, 17

Totten, Fort, N. Y., building for School of Submarine Defense..... i, 13, 16

Tower, F. D. (canal boat), removal of wreck of..... i, 158, 954

Town Creek, Brunswick County, N. C., improvement of..... i, 242; ii, 1113

Town River, Mass., improvement of..... i, 82, 772

Trail Creek, Ind.:

Improvement of Michigan City inner harbor..... i, 498; iii, 1931

Improvement of Michigan City outer harbor..... i, 498, 499; iii, 1931

Traverse Lake, Minn., survey of..... i, 404; ii, 1549

Trent River, N. C.:

Harbor lines at Newbern..... i, 640; ii, 1114

Improvement of..... i, 234; ii, 1099

Trinity River, Tex.:

Bridge across..... i, 648

Improvement of..... i, 354, 355; ii, 1338, 1339

Troops:

Battalions of Engineers..... i, 5, 7, 18, 669, 686; iv, 2906

Engineer equipment of..... i, 23, 697

Service of officers of the Corps of Engineers with..... i, 24

Tucker Beach light-house, N. J., removal of wreck..... i, 194, 1026

Tuckerton Creek, N. J., improvement of..... i, 172, 990

Tug Fork, Big Sandy River, W. Va. and Ky., improvement of..... i, 448; ii, 1742

Tunnel, Washington Aqueduct, D. C..... i, 654, 655; iv, 2485, 2499

Turners Cut, N. C., improvement of waterway via..... i, 225; ii, 1083

Turtle River, Ga. (see Brunswick Harbor)..... i, 267; ii, 1164

Twelve-mile Creek, Fla. (see Orange River)..... i, 282; ii, 1194

Twelve-mile Creek, N. Y. (see Wilson Harbor)..... i, 564; iii, 2147

Twin Rivers, Wis. (see Two Rivers Harbor)..... i, 481; ii, 1850

Two Harbors, Minn., improvement of Agate Bay..... i, 465; ii, 1793

Two Rivers Harbor, Wis., improvement of..... i, 481; ii, 1850

Tyaskin (Wetipquin) Creek, Md., improvement of..... i, 190, 1018

U.

Union Bridge Company, bridge of..... i, 651

Union Lake, Wash.:

Improvement of waterway via..... i, 629; iii, 2332

Reexamination of waterway via, with plans and estimates of cost. i, 630; iii, 2340

Union River, Me., improvement of..... i, 41, 715

United Railways and Electric Company of Baltimore,
 United States and West Indies Railroad and Steamship
 Urbana Creek, Va., improvement of
 Uriarte No. 4 (steamer), removal of wreck of.....

V.

Vanmatre, A. R., bridge of
 Van Sciver (schooner), removal of wreck of
 Venango County, Pa.:
 Bridge of, across Allegheny River at Franklin....
 Bridge of, across Allegheny River at Kennerdell
 Vermilion Bayou, La., improvement of channel, bay,
 Vermilion Harbor, Ohio, improvement of

Vessels:

See also Dredge and Snag boats, and Wrecks.
 Rules governing running of steamboats on certain
 Vicksburg Harbor, Miss., improvement of.....
 Vidalia Harbor, La. (*see* Mississippi River Commission)
 Vinalhaven, Me., improvement of Carvers Harbor...
 Vineyard Haven, Mass., improvement of harbor at ..
 Vineyard Sound light-ship, Mass., removal of wreck .
 Visayas, department of the, reconnaissances and expl
 Volusia bar, St. Johns River, Fla., improvement of..

W.

Wabash River, Ind. and Ill.:
 Improvement above Vincennes, Ind.
 Improvement below Vincennes, Ind.
 Operating and care of Grand Rapids lock and dam
 Waccamaw River, N. C. and S. C.:
 Bridge at Conway, S. C.
 Improvement of
 Wachapreague Inlet life-saving station, Va., removal
 Wadena (barge), removal of wreck of
 Wade Point light, Albemarle Sound, N. C., removal of
 Wakefield, Va., wharf at Bridge Creek Landing near.
 Wallace Creek, S. C., bridge of Colleton County
 Wand, George H. (schooner), removal of wreck of...
 Wappinger Creek, N. Y., improvement of
 Wappoo Cut, S. C., improvement of
 War College, Army, Washington, D. C., buildings for
 War maps
 Warrior River, Ala.:
 Improvement above Tuscaloosa
 Improvement below Tuscaloosa
 Operating and care of locks and dams
 Removal of wreck
 Warroad Harbor and River, Minn., improvement of .
 Warwick River, Md., improvement of
 Washakie, Fort, Wyo., road to Buffalo Fork, Snake R
 Washington, D. C.:
 Aqueduct Bridge across Potomac River, repair of
 Aqueduct, Dalecarlia reservoir
 Aqueduct, filtration plant, with report concerni
 ment of Potomac water
 Aqueduct, increasing water supply
 Aqueduct, maintenance and repair
 Aqueduct tunnel and Howard University reservo
 Army War College, buildings for.....
 Barracks
 Battalions of Engineers
 Defenses of, including report on damp-proofing .
 Engineer depot.
 Engineer School of Application, including buildi
 Executive Mansion and office.....
 Government Printing Office, new building for...

Washington, D. C.—Continued.

- Highway bridge across Potomac River to replace Long Bridge i, 643, 653; iv, 2484
Improvement of Anacostia River at i, 200; ii, 1040
Improvement of Potomac River at i, 197; ii, 1035
Improvement of Potomac River below i, 200; ii, 1038
Memorial Bridge across Potomac River i, 653; iv, 2484
Public buildings and grounds, and Washington Monument i, 658; iv, 2517
Statues and memorials i, 658; iv, 2517
Survey of United States land within flats of Anacostia River i, 36
Washington County (Me.) Railroad Company, bridge of i, 652
Washington Lake, Wash.:
Bridge at Seattle, across right of way of waterway to Puget Sound i, 645
Improvement of waterway to Puget Sound i, 629; iii, 2332
Reexamination of waterway to Puget Sound, with plans and estimates of cost i, 630; iii, 2340
Washington Monument, D. C. i, 658; iv, 2517
Washington Parish, La., bridge of i, 650
Washita (Ouachita) River, Ark. and La., improvement of i, 366; ii, 1373
Water craft:
See also Dredge and Snag boats, and Wrecks.
Rules governing running of steamboats on certain streams i, 641
Wateree River, S. C.:
Bridge near Kingsville i, 646
Improvement of i, 249; ii, 1128
Water hyacinths:
Removal of, from Florida waters, including report on experiments made i, 279; ii, 1184; iv, 2433
Removal of, from Louisiana waters i, 343; ii, 1312
Removal of, from Texas waters i, 343
Water-level observations:
Columbia River, Oreg. and Wash i, 619; iii, 2321
Michigan Lake, variations in surface level on east shore i, 498
Mississippi River and principal tributaries i, 405; ii, 1549; S., 7, 8, 62, 97
Northern and Northwestern Lakes, including report on outflow, rainfall, and evaporation i, 665; iv, 2678, 2855
Waters, navigable. *See Bridges, Rivers and harbors, and Wrecks.*
Water supply, Washington, D. C. *See Washington, D. C.*
Waterways (*see also Canals*):
Beaufort, N. C., to Newbern i, 235; ii, 1101
Beaufort, N. C., to New River i, 236; ii, 1103
Charleston to Beaufort, S. C., improvement of i, 255; ii, 1138
Charleston to Beaufort, S. C., sunken logs i, 257; ii, 1140
Charleston to McClellanville, S. C., with estimates of cost i, 252; ii, 1132
Chincoteague Bay, Va., to Delaware Bay, Del. i, 180, 1002
Galveston to Houston, Tex. i, 351; ii, 1334
Keweenaw Bay to Lake Superior, Mich., improvement and care i, 471, 472; ii, 1815
Keweenaw Bay to Lake Superior, Mich., wreck i, 475; ii, 1827
Lockport, Ill., to St. Louis, Mo., via Illinois, Des Plaines, and Mississippi rivers i, 494, 639; iii, 1904; S., 7, 68, 167
Norfolk, Va., to Albemarle Sound, N. C., via Currituck Sound... i, 226; ii, 1084
Norfolk, Va., to sounds of North Carolina, via Pasquotank River.. i, 225; ii, 1083
Portage Lake and Lake Superior canals, improvement and care i, 471, 472; ii, 1815
Portage Lake and Lake Superior canals, wreck i, 475; ii, 1827
Puget Sound to Lake Washington, bridge at Seattle, Wash i, 645
Puget Sound to Lake Washington, improvement and reexamination of i, 629; iii, 2332, 2340
Savannah, Ga., to Beaufort, S. C. (*see Savannah Harbor*) i, 257; ii, 1141
Savannah, Ga., to Fernandina, Fla i, 269; ii, 1166
Shreveport, La., to Jefferson, Tex. (*see Cypress Bayou*) i, 365; ii, 1372
Superior Lake to Lake Huron, final report on survey i, 542
Waukegan Harbor, Ill., improvement of i, 488; ii, 1864
Western Branch, Elizabeth River, Va., improvement of i, 220; ii, 1076
Western Bridge Company, bridge of i, 644
Western Maryland Tidewater Railroad Company, bridge of i, 649

- Western Pennsylvania Railroad Company, bridges of
- West Galveston Bay, Tex., improvement of
- West Neebish channel, St. Marys River, Mich., imp
- Westport Harbor, Conn., improvement of
- West River, Conn., bridge between New Haven and
avenue.....
- Wetipquin (Tyaskin) Creek, Md., improvement of ..
- Weymouth River, Mass., improvement of
- Whatcom Creek and Harbor, Wash.:
 - Bridge across I and J streets waterway
 - Bridge across Whatcom Creek waterway
 - Improvement of
- White Cliffs, Ark., bridge across Little River.....
- Whitehall, N. Y.:
 - Improvement of Narrows of Lake Champlain....
 - Removal of wrecks in Lake Champlain near....
- Whitehouse, Ky., bridge across Levisa Fork, Big Sa
- White House, Washington, D. C.
- White Lake Harbor, Mich., improvement of
- White River, Ark.:
 - Bridge between Arkansas and Desha counties ..
 - Bridge between Baxter and Marion counties ...
 - Bridge at Newport
 - Gauging (*see* Mississippi River Commission)
 - Improvement by open-channel work
 - Improvement of Buffalo Fork
 - Improvement of upper river by locks and dams ..
- White River, Ind., improvement of.....
- White River Railway Company, bridge of
- Wicomico River, Md., improvement of
- Willamette River, Oreg.:
 - Improvement above Portland
 - Improvement below Portland
- Willapa River and Harbor, Wash., improvement of.
- Willets Point, N. Y., building for School of Submarine
- Williams, O. C. (steamer), removal of wreck of
- Williamsport (steamer), removal of wreck of
- Willow River, Minn. (*see* Mississippi River reservoir
- Wilmington, Cal.:
 - Construction of deep-water harbor in San Pedro
 - Improvement of inner harbor
- Wilmington, Del.:
 - Bridge across Brandywine Creek
 - Improvement of harbor.....
- Wilmington, N. C.:
 - Defenses of Cape Fear River, including report on
use of paint made of coal tar and kerosene oil
 - Improvement of Cape Fear River at and below ..
 - Improvement of Cape Fear River above.....
- Wilson Harbor, N. Y., improvement of
- Wilson, Pa., harbor lines in Monongahela River....
- Wilson, Point, Cal. (*see* San Pablo Bay).....
- Wilson, Thomas (steamer), removal of wreck of ...
- Wind Point, Lake Michigan, Wis., reef off.....
- Winnebago Lake, Wis. (*see* Fox River)
- Winnibigoshish Lake, Minn.:
 - Construction of reservoir dam
 - Operating and care of reservoir dam
- Winslow, Richard (barge), removal of wreck of
inac
- Winthrop Cove, New London, Conn. (*see* New Lond
- Winyah Bay, S. C., improvement of.....
- Wisconsin Central Railway Company:
 - Bridge of, across Fox River
 - Bridge of, across Mississippi River.....
- Wisconsin Entrance, Duluth Harbor, Minn., improv

Wisconsin River, Wis.:

Bridge at Prairie du Chien	i, 648
Improvement of (<i>see</i> Fox River)	i, 489; ii, 1866
Withlacoochee River, Fla., improvement of	i, 288; ii, 1202
Wolf River, Memphis, Tenn. (<i>see</i> Mississippi River Commission)	i, 639; S., 3, 40
Wolf (Ahnapee) River, Wis. (<i>see</i> Ahnapee Harbor)	i, 480; ii, 1847
Wolf River (tributary of the Fox), Wis. (<i>see</i> Fox River)	i, 489; ii, 1866
Woodbridge Creek, N. J., improvement of	i, 149, 935
Woods Hole channel, Mass., improvement of	i, 91, 793
Wrecks, etc., removal of	i, 35
Albany, N. Y.	i, 139, 888
Albemarle Sound, N. C.	i, 228; ii, 1088
Apalachicola, Fla., opposite	i, 306; ii, 1236
Arthur Kill, N. Y. and N. J.	i, 158, 159, 955, 956
Ashley River, S. C.	i, 257; ii, 1140
Bass Rip, Mass.	i, 104, 820
Bayonne, N. J.	i, 159, 955
Beaufort-Charleston, S. C., waterway, sunken logs	i, 257; ii, 1140
Bergen Point, N. J., opposite	i, 158, 954
Bergen Point reef, N. J., on	i, 158, 954
Black Warrior River, Ala.	i, 324; ii, 1272
Boothbay Harbor, Me.	i, 53, 727
Boston Harbor, Mass.	i, 88, 785
Braddock Point light station, Lake Ontario, N. Y.	i, 575; iii, 2169
Bronx River, N. Y.	i, 138, 139, 887
Brooklyn, N. Y., East River	i, 139, 887
Buffalo Bayou, Tex.	i, 360, 361; ii, 1347
Buttermilk channel, New York Harbor, N. Y.	i, 145, 925
Camden, N. J., Cooper Creek	i, 194, 1024
Cape Poge light-house, Mass.	i, 103, 819
Carters Creek, Va.	i, 218; ii, 1071
Champlain Lake, N. Y. and Vt.	i, 73, 753
Charleston-Beaufort, S. C., waterway, sunken logs	i, 257; ii, 1140
Chatham, Mass., off Hardings Beach light	i, 103, 820
Chincoteague light-house, Va.	i, 194, 1024
Cleveland Harbor, Ohio	i, 556; iii, 2105
Coeymans (North), N. Y.	i, 139, 888
Cohansey Creek, N. J.	i, 194, 1024
Cooper Creek, N. J.	i, 194, 1024
Cross Ledge light-house, Delaware Bay	i, 165, 971
Cumberland River, Dover Island Chute	i, 417; ii, 1589
Cumberland Sound, Ga. and Fla.	i, 271; ii, 1171
Deal Island Harbor, Md.	i, 194, 1024
Delaware Bay and River	i, 165, 971, 972
Dover Island Chute, Cumberland River	i, 417; ii, 1589
Duluth, Minn., Lake Superior near	ii, 1828
East River, N. Y.	i, 139, 887
Elizabethport, N. J.	i, 158, 159, 955
Elizabeth River, N. J.	i, 159, 955
Erie Lake	i, 556; iii, 2103
Fairport Harbor, Ohio	i, 556; iii, 2106
False Egg Island Point, Delaware Bay	i, 165, 971
Fenwicks Island shoal, Md.	i, 194, 1024
Galveston Bay, Tex.	i, 360, 361; ii, 1347
Gowanus Creek, N. Y.	i, 145, 924
Green Run Inlet life-saving station, Md.	i, 194, 1023
Hampton Roads, Va.	i, 228; ii, 1088
Handkerchief shoal, Mass.	i, 103, 820
Hardings Beach light, Mass.	i, 103, 820
Hen and Chickens light-ship, Mass.	i, 104, 820
Hoboken, N. J.	i, 139, 887
Hoffman Island, New York Harbor, N. Y.	i, 145, 925
Hudson River, N. Y. and N. J.	i, 139, 887, 888
Hyannis Harbor, Mass.	i, 103, 819
Keweenaw Bay-Lake Superior waterway	i, 475; ii, 1827
Key West Harbor, Fla.	i, 281; ii, 1187
Lambs, S. C.	i, 257; ii, 1140

Wrecks, etc., removal of—Continued.

Larabee Landing, Lake Champlain, Vt.....	i, 73, 7
Leipsic River, Del.....	i, 194, 10
Little Creek, Del.....	i, 194, 10
Little Duck Creek (Leipsic River), Del.....	i, 194, 10
Lorain Harbor, Ohio.....	i, 556; iii, 21
Mackinac Straits, Mich.....	i, 542; iii, 20
Main Ship channel, New York Harbor, N. Y.....	i, 145, 924, 9
Marine City, Mich.....	iii, 20
Maumee Bay, Ohio.....	i, 557; iii, 21
Metuchen, N. J.....	i, 159, 9
Middle Island light-house, Lake Erie.....	i, 556; iii, 21
Mississippi River, above Missouri River.....	i, 393; ii, 14
Mississippi River, below Missouri River.....	i, 389; ii, 14
Mobile Harbor and River, Ala.....	i, 324; ii, 12
Monomoy Point, Mass.....	i, 103, 819, 8
Nantucket Sound, Mass.....	i, 103, 819, 8
Nauset Harbor, Mass.....	i, 88, 7
Newark, N. J.....	i, 159, 9
Newark Bay, N. J.....	i, 158, 159, 954, 9
Newport News Point, Hampton Roads, Va.....	i, 228; ii, 10
New York Harbor, Arthur Kill, N. Y.....	i, 158, 159, 955, 9
New York Harbor, Bronx River, N. Y.....	i, 138, 139, 8
New York Harbor, Buttermilk channel, N. Y.....	i, 145, 9
New York Harbor, East River, N. Y.....	i, 139, 8
New York Harbor, Gowanus Creek, N. Y.....	i, 145, 9
New York Harbor, Hoffman Island, N. Y.....	i, 145, 9
New York Harbor, Hudson River near Hoboken, N. J.....	i, 139, 8
New York Harbor, Main Ship channel, N. Y.....	i, 145, 924, 9
New York Harbor, Southwest Spit, N. Y.....	i, 145, 9
New York Harbor, off Tompkinsville, N. Y.....	i, 145, 9
North Coeymans, N. Y.....	i, 139, 8
North (Hudson) River, N. Y.....	i, 139, 8
North River, N. C.....	i, 228; ii, 10
Ontario Lake.....	i, 575; iii, 21
Pasquotank River, N. C.....	i, 228; ii, 10
Passaic, N. J., in Passaic River.....	i, 158, 9
Passaic Bridge, in Passaic River.....	i, 158, 9
Passaic light-house, Newark Bay, N. J.....	i, 159, 9
Passaic River, N. J.....	i, 158, 159, 954, 9
Philadelphia, Pa., Delaware River.....	i, 165, 9
Philadelphia, Pa., Schuylkill River.....	i, 194, 10
Poge, Cape, light-house, Mass.....	i, 103, 8
Pollock Rip light-ship, Mass.....	i, 103, 8
Popee Island, Va.....	i, 194, 10
Portage Lake canals, Mich.....	i, 475; ii, 18
Port Huron, Mich., near.....	iii, 20
Port Reading, N. J.....	i, 159, 9
Potomac River, Md.....	i, 218; ii, 10
Ram Island light-house, Boothbay Harbor, Me.....	i, 53, 7
Rancocas River, N. J.....	i, 194, 10
Raritan River, N. J.....	i, 159, 9
River View, Potomac River, Md.....	i, 218; ii, 10
St. Clair River, Mich.....	i, 542; iii, 2048, 20
Sankaty Head, Nantucket Island, Mass.....	i, 104, 8
Savannah Harbor, Ga.....	i, 271; ii, 11
Schuylkill River, Pa.....	i, 194, 10
Ship John light-house, Delaware Bay.....	i, 165, 971, 9
Shipyards Landing, Pasquotank River, N. C.....	i, 228; ii, 10
Shovelful shoal, off Monomoy Point, Mass.....	i, 103, 819, 8
Southwest Spit, New York Harbor, N. Y.....	i, 145, 9
Starve Island reef, Lake Erie.....	i, 556; iii, 21
Staten Island Sound (Arthur Kill), N. Y. and N. J.....	i, 158, 159, 955, 9
Superior Harbor, Wis., Lake Superior, near.....	ii, 11
Superior Lake, near Duluth, Minn.....	ii, 11
Superior Lake-Keweenaw Bay waterway.....	i, 475; ii, 11
Tangier Sound, Md., Deal Island Harbor.....	i, 194, 10

Wrecks, etc., removal of—Continued.

Toledo Harbor, Ohio, Maumee Bay	I, 557; III, 2106
Tompkinsville, N. Y.	I, 145, 924
Tucker Beach light-house, N. J.	I, 194, 1026
Vineyard Sound light-ship, Mass.	I, 104, 820
Wachapreague Inlet life-saving station, Va.	I, 194, 1024
Wade Point light, Albemarle Sound, N. C.	I, 228; II, 1088
Warrior River, Ala.	I, 324; II, 1272
Whitehall, N. Y.	I, 73, 753
York River, Va.	I, 218; II, 1071
Wyandotte, Mich. (<i>see</i> Detroit River)	I, 540; III, 2036

Y.

Yamhill River, Oreg.:

Improvement of	I, 609; III, 2257
Operating and care of lock and dam	I, 612; III, 2261

Yankton, S. Dak. (*see* Missouri River)

Yaquina Bay, Oreg., improvement of	I, 600; III, 2215
--	-------------------

Yazoo River, Miss.:

Improvement above mouth	I, 373; II, 1396
Improvement of mouth, including Vicksburg Harbor	I, 370; II, 1385

Yellow Mill Pond, Bridgeport, Conn. (*see* Bridgeport)

Yellowstone National Park, improvement of, with report giving technical details	I, 115, 846
.....	I, 666; IV, 2444, 2885

York River, Va.:

Improvement of	I, 204; II, 1050
Removal of wreck	I, 218; II, 1071

Yuba River, Cal. (*see* Sacramento River and California Débris Commission)

.....	I, 587, 638; III, 2194, 2368
-------	------------------------------

O





